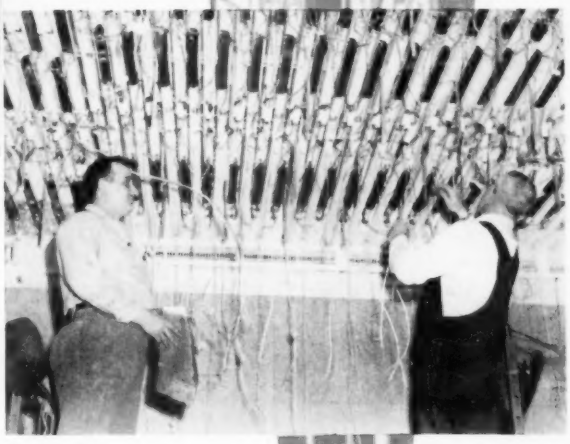
Electrical Construction and Maintenance

WITH ELECTRICAL CONTRACTING

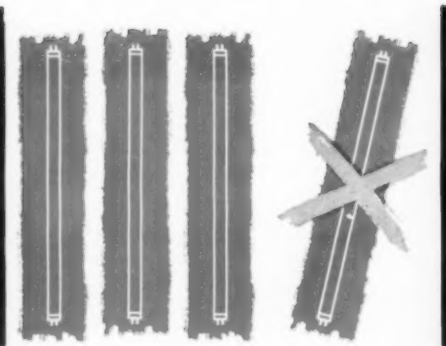
JUNE • 1958
PRICE 40 CENTS

Houston Federal Reserve electrical system operates at 840 cycles with power-line carrier control.



Cleveland office building features lighting installation of 450 footcandles, dimmer controlled.

McGRAW-HILL PUBLICATION | 57TH YEAR



three lamps do more than four with Prismoid

Engineer: John D. Severance,
Iowa-Illinois Gas & Elect. Co.
Rock Island, Ill.
Contractor: L & W Elec. Co., Rock Island, Ill.
Wholesaler: B & M Elec. Dist. Co., Rock Island, Ill.

GUTH PEERLITES® WITH PRISMOID GRATELITE* LOUVERS AT McCABE'S, ROCK ISLAND, ILL.

Originally, this job was laid out for 50 footcandles with Brand X fixtures (4 lamp—75 watt).
But McCabe bought Guth Peerlites with Prismoid Louvers, using only *three* 75-watt lamps.
Result: 100% more light than with the 4-lighters!
And more! The crystal beauty and cheerful atmosphere created by Prismoid flatters the merchandise and puts shoppers in a buying mood.

100 FOOTCANDLES WITH ONLY
2.5 WATTS PER SQUARE FOOT—THAT'S EFFICIENCY!

Get the complete story of Prismoid efficiency, beauty and breathing action—write us on your letterhead today!

PRISMOID
GRATELITE

Guth

THE EDWIN F. GUTH COMPANY
ST. LOUIS 3, MO.

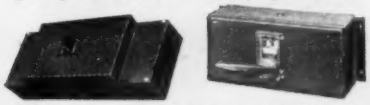
TRUSTED NAME IN LIGHTING SINCE 1902

*T. M. Reg. U.S. & Can. Pats. Pend.

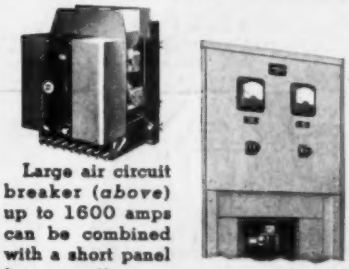
SQUARE D's NEW Unit Substation

IN POWER-STYLE CONSTRUCTION

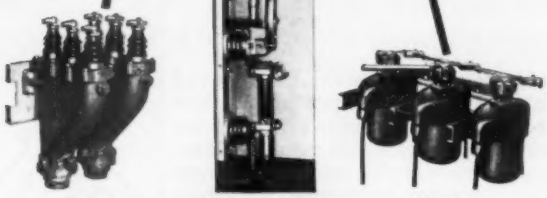
Designed to match Square D's Power-Style switchboards and control centers, these new Unit Substations meet NEMA, ASA, and AIEE standards. Available from 75 to 500 KVA; in primary voltages up to 4800V; secondary up to 600V.



Molded case circuit breakers (*left*) up to 800 amperes and QMB Saflex fusible switches (*right*) up to 600 amperes are available in compact panel construction.



Large air circuit breaker (*above*) up to 1600 amps can be combined with a short panel in one section.



Pothead | Interrupter Switch | Cutout

Potheads, fused or unfused load break air-interrupter switches and fused or unfused oil-filled cutouts are available. Air-interrupter switches and cutouts are easily accessible from front of Substation.

REAR VIEW

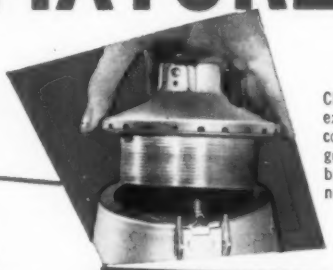
3 single phase, dry-type transformers individually mounted on base in ventilated enclosure—heating and vibration held to a minimum. Transformers easily accessible for maintenance and inspection. When no air circuit breaker or metering equipment is used, entire area at top left is available for pull box.

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY

APPLETON "AA-51" SERIES VENTED EXPLOSION-PROOF LIGHTING FIXTURES

Exclusive NEW Anti-Vibration Guard!

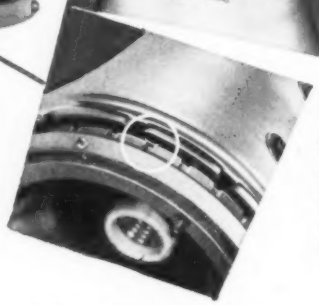


Close-up showing canopy, extra-safe multiple "AA-51" contact threads, and anti-vibration guard with V-shaped metal prong before engaging canopy notches.

Canopy is securely locked against vibration disturbance by positive engagement of V-shaped metal prong in tightly sealed canopy notch. This anti-vibration guard may be quickly released by hand pressure for maintenance.

Interchangeable Unilet

Identical dimensions "A" on Dome Assemblies permit quick interchange of fixtures with different wattages (from 60 Watt to 500 Watt).



Similar in action to canopy guard, this close-up shows anti-vibration guard locking globe ring to dome unit assembly. Metal prong in dome unit is securely engaged by notched globe ring to prevent accidental loosening. This anti-vibration guard also may be quickly released by hand pressure for maintenance.

58 Second Relamping

Series "AA-51" stand-by units are ready at an instant's notice for relamping... with handles attached in advance.

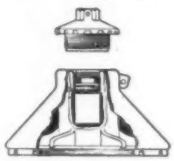
Only a screwdriver is needed to change units . . . and only 58 seconds to climb ladder, change unit, and descend.

Cleaning fixtures, changing burned-out lamps, can be done safely at bench . . . . preventing costly shutdowns.

The fixture with "all" the features now sets even greater standards of efficiency and safety!

APPLETON'S new anti-vibration guard on all "AA-51" vented explosion-proof fixtures assures users of positive protection against spark caused mishaps due to vibration conditions. Coupled with multi-thread safety design where a "flame-tight" contact chamber permits servicing *even with the current on*, this new anti-vibration guard demonstrates APPLETON'S continuing quality research program to bring you the finest in electrical products. Check these other features for proof of "AA-51" design leadership and adaptability for your requirements. Write for complete information today.

Sold through franchised wholesalers only



"Full Circle Venting"
Porous metal interior and specially designed hood dissipate heat evenly and safely . . . keep fixture temperature down, provide longer lamp life.

APPLETON ELECTRIC COMPANY
1718 Wellington Avenue, Chicago 13, Illinois

APPLETON ELECTRIC PRODUCTS

Also manufacturers of:

Industrial Lighting Equipment

Automatic Reelites

"ST" Series Connectors

Malleable Iron Unilets

Electrical Construction and Maintenance

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Published for electrical contractors, electrical departments in industry, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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Channel grid provides unique support for storage bin lighting.

MORE

Specify PHELPS DODGE HABIRITE-INSULATED ARMO-LOK CABLE

Phelps Dodge Armo-Lok cable with Habirite (butyl rubber) insulation—a companion to Phelps Dodge Varnished Cambric insulated interlocked armor cable—is more than "just another interlocked armor cable."

Habirite—developed through years of Phelps Dodge experience in the design and manufacture of high voltage cables — is a specially engineered butyl rubber compound. It far surpasses any other type of rubber insulation for dependable service.

Habirite offers these distinct advantages over other rubber insulations:

- Far greater resistance to heat and oxidation with consequent higher temperature rating and lower conductor size and cable cost.
- Far greater resistance to ozone found around high voltage equipment.
- Far greater mechanical toughness.
- Better electrical properties affording a greater safety factor in operation.
- Highest uniformity due to controlled uniformity of raw material.

★ ★ ★

See your Phelps Dodge distributor for information on a complete Armo-Lok system. For catalogue and specification data on Habirite or Varnished Cambric insulated Armo-Lok cable, write: Dept. E-8, Phelps Dodge Copper Products Corporation, 300 Park Avenue, New York 22, N. Y.

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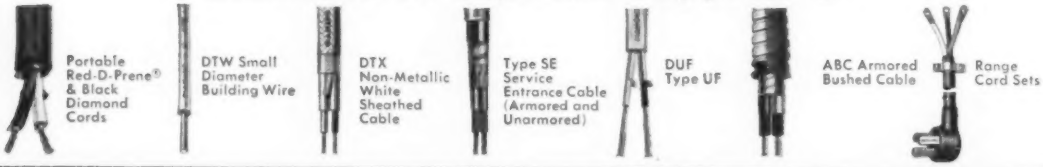
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ABC Armored Bushed Cable
Range Cord Sets

Trade Mark ®

DIAMOND

WIRE and **CABLE** Company

Sycamore, Illinois

WAREHOUSE: BIRMINGHAM, ALABAMA

Sidelights

FOR SAFER HIGH-CAPACITY SERVICES

The New York City Department of Water Supply, Gas and Electricity is preparing new installation rules for over 1200-amp secondary services to contend with the potential hazards of high-capacity systems backed up by low-impedance networks. The proposal, which is expected to be issued substantially in its draft form, is presented in this issue together with comments by Eitingon & Schlossberg Associates, consulting electrical engineers. See "High Capacity Secondary Services" beginning on page 82.

ENGINEERING MILESTONE

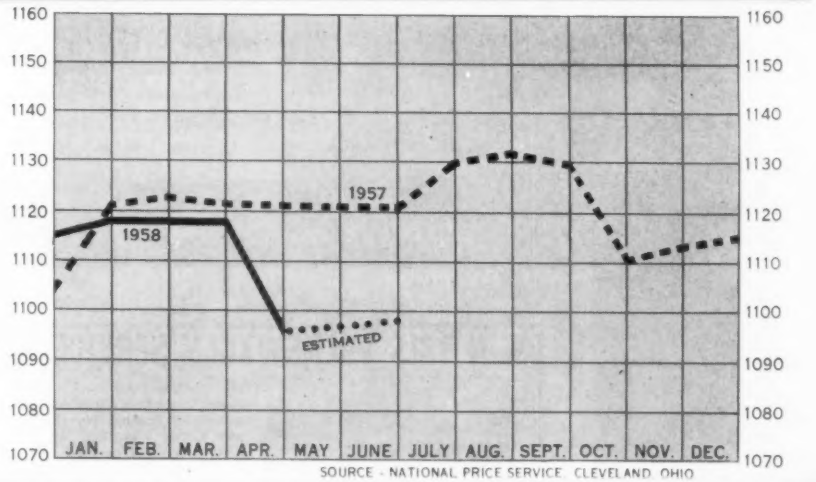
The electrical system today serving the Houston, Texas, Federal Reserve Bank represents a true engineering achievement. Here, the first overall high frequency distribution system in a commercial building supplies modern lighting throughout four floors. Providing high efficiency of electrical utilization, this 200-kw system serves its loads from a relatively simple layout of small feeders and few circuits. The increased efficiency of lamp operation at 840 cycles and the high efficiency of circuiting at 600 volts are the two key factors behind the success of this installation. A significant by-product of efficient electrical application was a substantial reduction in the capacity of air conditioning required for this completely windowless building. And the utilization convenience of the system is greatly enhanced by an elaborate system of program control in which carrier frequency pulses are transmitted from a central operations point to operate magnetic contactors and motor starters controlling loads throughout the building. Starting on page 71, installation and design details for the job under construction are described by J. H. Blasdell, superintendent for Fisk Electric Company, electrical contractors on the project.

MODERN SKYSCRAPER

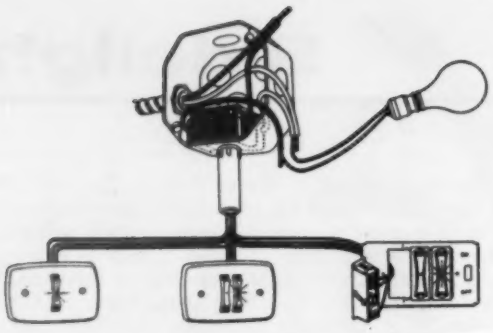
Cleveland has a new office skyscraper—an imposing shaft of aluminum and glass that provides tenants with top-flight lighting, year-round climate control, high-speed automatic elevators and unusual flexibility for transforming and distributing multi-voltage power to serve the needs of modern commerce. Other electrical features include innovations in the use of cellular flooring, low-noise-level transformers, dimmer control, comprehensive grounding, busduct risers and substations on the top floor as well as in the basement. Design and installation details of this outstanding commercial project may be found under the title of "Cleveland's New 24-Floor Office Building" beginning on page 89.

ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO



NEW

REMCON

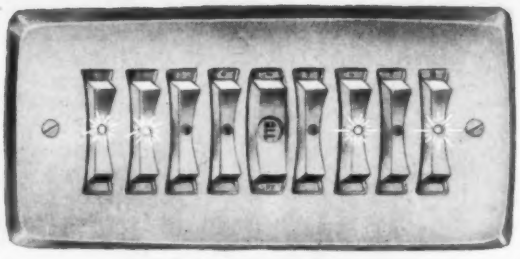
remote control switching with * pilot-lite indication

EASIER TO WIRE

REMCON means simpler wiring. Since a separate low-voltage power source does not have to be installed in the attic or basement, you simply hook the three wires of the relay to the three terminals of the switch. It's that easy!

EASIER TO SELL

REMCON provides modern, adequate switching . . . multi-point, light-path remote-control and master-control switching . . . features that are evident throughout the house. And REMCON'S handsome Hi-Fashion switches with Velvet Touch add richness to the decor of every home.



only REMCON has these features:

1. Built-in transformer means unit control...Each relay in the REMCON method operates independently from and has no effect upon other relays.
2. * "Pilot-Lite" indication without using additional wiring or transformers. Substitute REMCON "Pilot-Lite" relays and switches for standard... the "Pilot-Lite" circuit employs the same three wires used for wiring switch to relay.
3. Ideal for 3-way or 4-way switching. REMCON's complete flexibility means greater economy, broader application... elimination of external transformer makes installation of even one switch and one relay practical.
4. Operates silently...No annoying magnetic relay hum.
5. Unique 6-volt method replaces heavy armored cable with light, pliable #18 wire, making handling and stripping easier ...and with only 6 volts at the switch, REMCON is as safe to use as the family flashlight.
6. Extra safety features built in ...cannot burn out if low-voltage switch legs are shorted for extended period.

REMCON REMOTE CONTROL SWITCHING *a product of PYRAMID INSTRUMENT CORP. 630 Merrick Road, Lynbrook, New York*

WIN THIS VOLKSWAGEN SERVICE TRUCK

FREE to the man who submits the most imaginative and practical use of REMCON on actual installation. FOR FREE ENTRY ENVELOPE WITH ENTRY BLANK, FULL INFORMATION AND HELPFUL SUGGESTIONS, see your REMCON distributor or send this coupon.

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Washington Report

JUNE • 1958

Economic optimism is increasing as midyear approaches, and as national statistics reflect a leveling-out in most factors that have declined to varying degrees over the past nine to twelve months. Unemployment, one of the major worries of most Washington officials, has held at about 7% of the total labor force for some three months, and reports from industry and business leaders generally indicate that a business upturn is ahead, that the economy will revive without any new large pump priming schemes by the Government.

Design and construction contracts are being awarded at a stepped-up pace by General Services Administration, covering improvements to Federal buildings throughout the nation, and in areas of substantial unemployment. This is by direction of President Eisenhower, it was announced recently by Franklin Floete, GSA Administrator. Contracts generally include such improvements as air conditioning, ventilating, lighting, electrical work, building extensions, painting, etc., in post offices, court houses and other Federal buildings.

Private housing starts this year will jump 10% over 1957 starts, according to predictions of Federal housing officials and some home builders. This optimism is based on expected effects of easier mortgage terms put into effect April 1.

Housing starts in April numbered 95,000, for an adjusted annual rate of 950,000. This is an increase of 8% from March, but slightly below the year-earlier rate.

Electric power output continues to lag behind year-ago records, by about 2% average. Slowdown in manufacturing (autos, steel, heavy goods) accounts for the decline, as residential consumption of electricity continues to rise. Current residential power use is about 7% ahead of year-ago use.

Domestic shipments of electric lamps in 1957 were up 5.8% in dollar value compared with 1956. Total value for 1957 was $378 million, U. S. Census has reported. This compares with $184 million in 1947, or an increase of 105% in ten years. Export shipments last year were an additional $18 million.

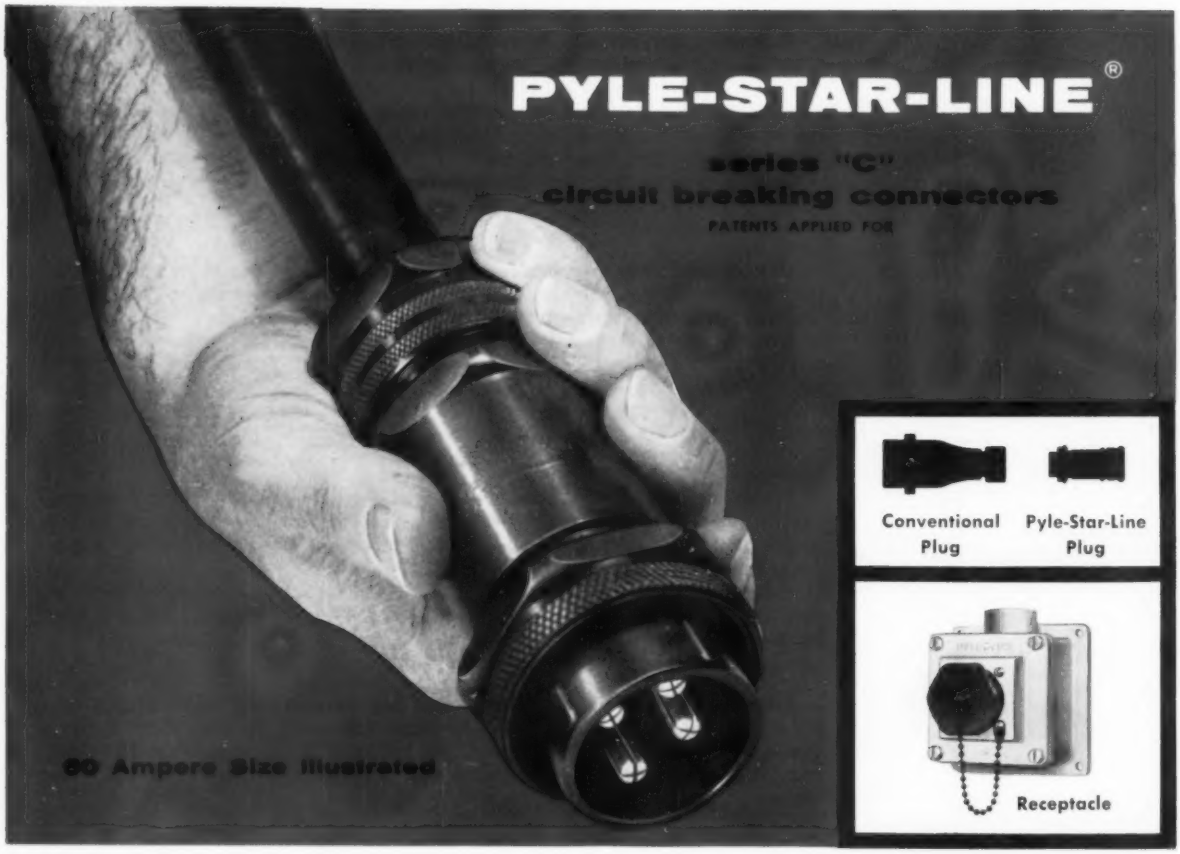
Fluorescent lamp ballast shipments in 1957 totaled $67 million, a decrease of 7% from the $73 million shipments in 1956. Corrected power factor types accounted for 55% of the quantity and 87% of the dollar value of all ballasts shipped last year.

Electrical workers in contract construction totaled 217,500 in January, down from the record 242,700 total reported for August 1957, according to Dept. of Labor. Average weekly earnings were $131.29, average weekly hours were 38.5, and average hourly earnings were $3.41, down 2¢ from the record set last October at $3.43. Hourly earnings were up 3.6% from January 1957.

Economic Highlights: Gross national product for the 1st quarter was at annual rate of $422 billion; Industrial output fell to 126% (of 1947-49 average); Personal income in April was at annual rate of $342.8 billion; Per capita tax load for fiscal 1958 will be about $658, up from $640 for fiscal 1957, $608 for fiscal 1956; Cost-of-living rose in April to 123.5% (record high) of the 1947-49 average; Employment in mid-April was 62.9 million, up 596,000 from March but down 1.35 million from a year earlier.

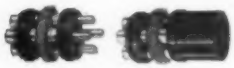
never before!

COMPACT, LOW-WEIGHT CONNECTORS WITH HIGH CURRENT RUPTURING RATINGS*



The new industrial series "C" Pyle-Star-Line connectors combine unique insulation and construction characteristics which make possible extraordinarily high circuit breaking ratings for the size and weight of the shell.

"Sandwich Insulation"—a resilient silicone insulation disc which floats between two rigid discs absorbs shock and vibration and permits the contacts to align themselves. The silicone, under pressure, reacts like a fluid. It flows into all crevices about the contact pins and sockets—positively prevents moisture or dust from passing through the insulation or accumulating to cause failures from short circuits or grounds.



Contact Inserts

Tough Anodic Coating of shell provides a smooth, attractive finish which has a hardness equal to 40 on the Rockwell C scale.

Rugged, Compact, Low-Weight Shell machined from high tensile strength aluminum...combined with the unique insulation features...provide a safe reliable, easy-to-handle connector which is highly resistant to the most punishing extremes of temperature, pressure, shock, vibration, corrosive dusts and moisture. Advantages never before combined in a single, standardized connector!

***Listed by Underwriters' Laboratories** in circuit breaking ratings of 30, 60, 100 and 200 ampere, 600 volt, A.C.

Write for 64-page catalog, No. 1252-I

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Are You Preparing *Now* For The Next Boom?

America's leading companies are not sitting on their hands waiting for the recession to end. They are planning ahead ***now*** for higher sales and near-capacity rates of operation.

These facts stand out clearly from the eleventh annual survey of Business' Plans for New Plants and Equipment just completed by the McGraw-Hill Department of Economics:

- **Manufacturing companies expect their sales to increase 20%, on the average, from 1958 to 1961.** Growth industries, such as chemicals and electrical machinery, expect gains of 25% to 34%.
- **If these sales gains are achieved, the average rate of operations in manufacturing will rise from 78% at the end of 1957 to almost 85% by 1961.** This is the point at which pressure on costs begins to mount, as less efficient facilities are pressed into service.
- **Industry is not waiting for this point to begin getting its plants and equipment in shape for the next boom.** Despite record expansion in the past several years, many manufacturing companies plan to add new capacity in each of the next four years. But, more important, they are going ahead with the vital job of modernization and cost-cutting.

In the years immediately ahead almost two-thirds of capital investment will go for modernization and replacement of present plants and equipment. In this way manufacturing companies can avoid the higher costs and the squeeze on profits that occur when producing facilities are not in shape to handle an increase in sales volume.

These are the plans, as reported to McGraw-Hill, of a wide sample of manufacturing companies—for the most part, large firms and leaders in their respective industries. Altogether, these firms account for almost 40% of all employment in manufacturing industries.

Now Is The Time

How do your plans measure up? Are you planning ahead now for a 20% sales increase in the next three years? Is your company planning to modernize its buildings and equipment more rapidly than at any time in the recent past? If not, here are some of the inducements

that McGraw-Hill editors report from their continuous checking on the state of business.

(1) **There are plenty of opportunities for increasing efficiency by the installation of new equipment and the improvement of layouts in plants, warehouses and offices.** Despite the installation of tremendous volumes of metalworking equipment in recent years, according to AMERICAN MACHINIST over half of the machine tools now in U. S. factories are over 10 years old. Replacement of worn-out and obsolete equipment will mean material savings in operating and maintenance costs.

(2) **Machinery, parts, materials and labor are much more readily available now than they are when the economy is running at full steam.** You can be more particular about quality and about specification to meet your own requirements.

(3) **With lower interest rates and less competition for loans, it is both easier and cheaper to borrow money to finance equipment and construction.** To wait for another boom is to run the risk of having to pay higher interest rates and look harder for money.

(4) **Although there is an adequate supply of most types of labor available now, the prospect is that the supply of factory labor over the years ahead will be tight.** In 1965, there will actually be fewer men and women between the ages of 25 and 44 than there are now. Good factory workers will be either hard to get, or wage rates will rise sharply or—more likely—both. The best answer is to anticipate the rise in labor costs by installing more efficient equipment to increase labor productivity.

(5) **Finally, the costs of investing in new buildings and improved equipment *now* are almost surely less than they will be later.**

These are some of the reasons why many leading firms find ***now*** the best time in years to start on a program of plant modernization. There are other good reasons in the many new products and processes coming from the boom in research and development. This year industry will spend over $8 billion on R & D—$1 billion more than in 1957. And a heavy share of the new product development will consist of better machines and processes to be made available during the next few years. Already the pace of technical advance is so rapid as to call for modernization of plants built only a few years ago.

Years of Opportunity

It has been said that the years between now and 1961 are the "middle years" between two booms. This does not mean a long period of recession, but a period of slower growth—a transition from the postwar boom based on deferred demand, to a new boom in the 1960s based on dynamic population growth and a revolution in technology.

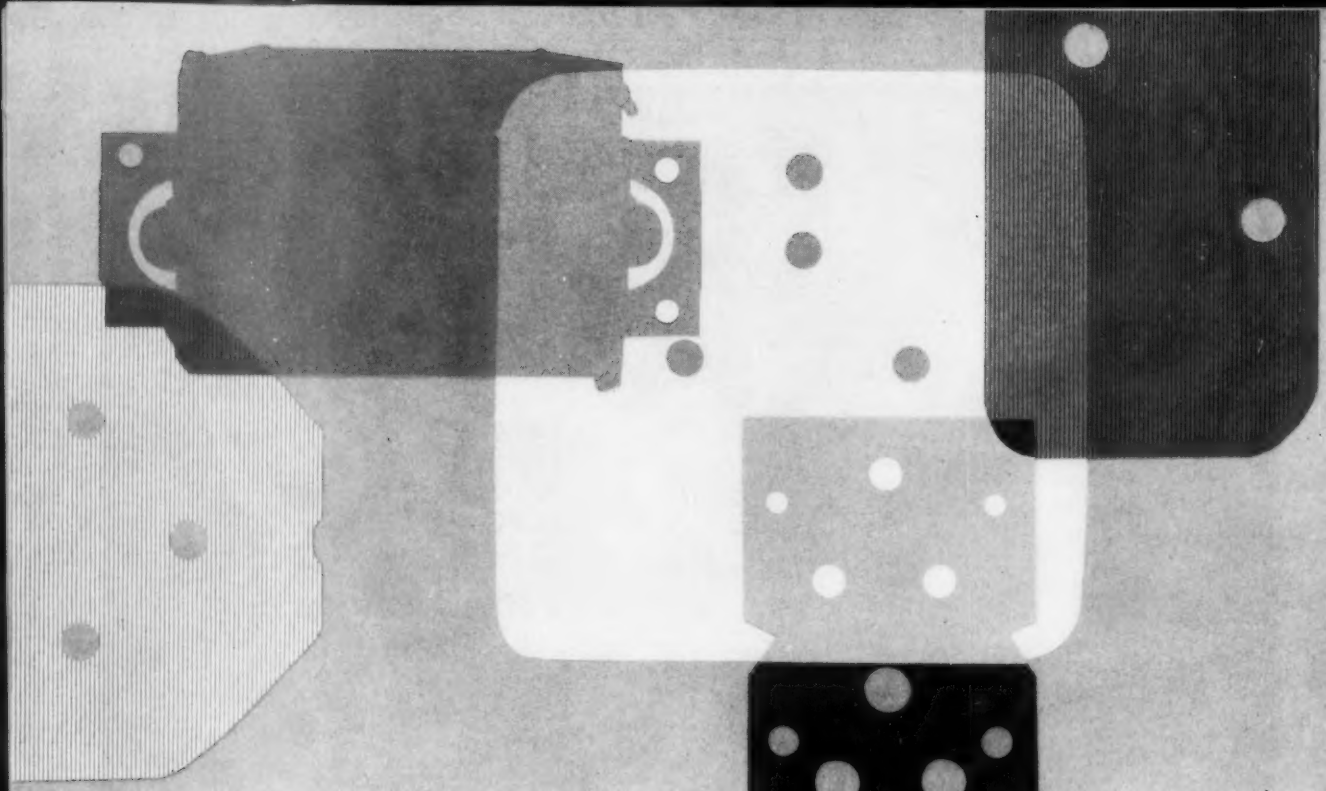
If so, these are the years of opportunity for business—opportunity to prepare for the growth that lies ahead with the most efficient equipment, the most modern plant and the best production organization that can be devised. This is the way to fight higher costs and avert a resumption of inflation. This is also the way to ensure that your company will be ready for its new markets in the 1960s.

Are you planning ahead ***now*** to be among the leaders?

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

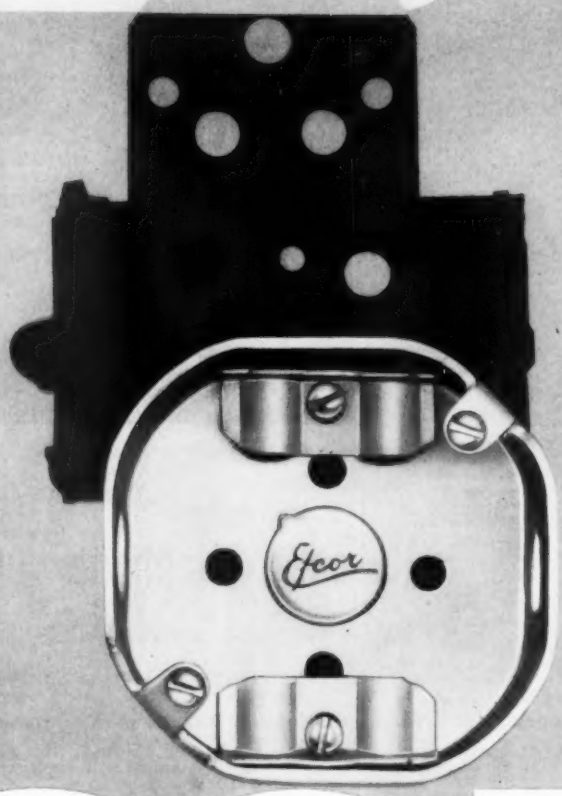
Donald C. McGraw
PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.



the new line... the full line... in boxes!

The first name in fittings—is now your first choice in boxes! Many months of field work with contractors—elaborate development and engineering have underscored the launching of this major line in boxes. It offers every clean, crisp, quality feature you demand—clean knockouts, heavy-gauge steel construction, bright galvanize finish with anti-corrosive chromate protection. More than *350 items fill out* this new complete line—including *switch and outlet boxes, bar hangers and covers*—everything to meet every one of your requirements. Be sure to specify Efcor—in boxes and fittings—you can't buy better!

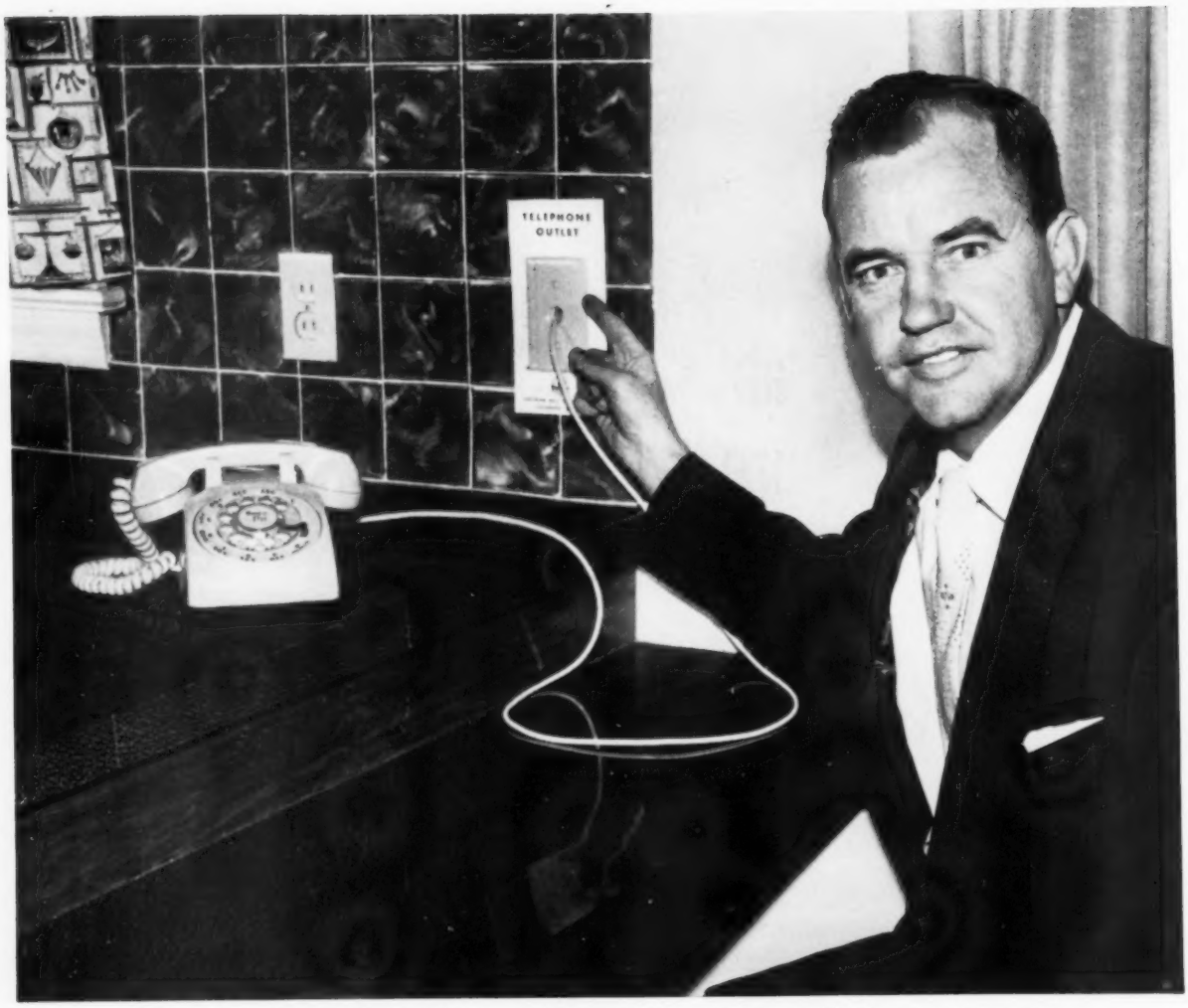


EFCOR

SWITCH AND OUTLET BOXES

ELECTRICAL FITTINGS CORP. · 37-50 57th St., Woodside 77, N. Y.

Send for this **36-page** informative, illustrated catalog of Efcor Boxes—today!



Mr. Hughes points to the kitchen telephone outlet in one of his new "Chestnut Hills" homes, near Greenville.

"For very little cost, telephone outlets add a big sales plus"

—says JACK HUGHES, *Builder, of Greenville, S. C.*

"Concealed telephone wiring is a tremendous sales feature," says Mr. Hughes. "We feature it in our advertising and tell our salesmen to use it as a major sales point. People actually look as much for telephone outlets as they do for electrical outlets.

"To stay competitive we must put in extras—and telephone outlets are an extremely reasonable value to a builder. For very little cost, they add a big sales plus to a home. Prospects can see that these outlets are going to mean convenience and an attractive telephone installation."

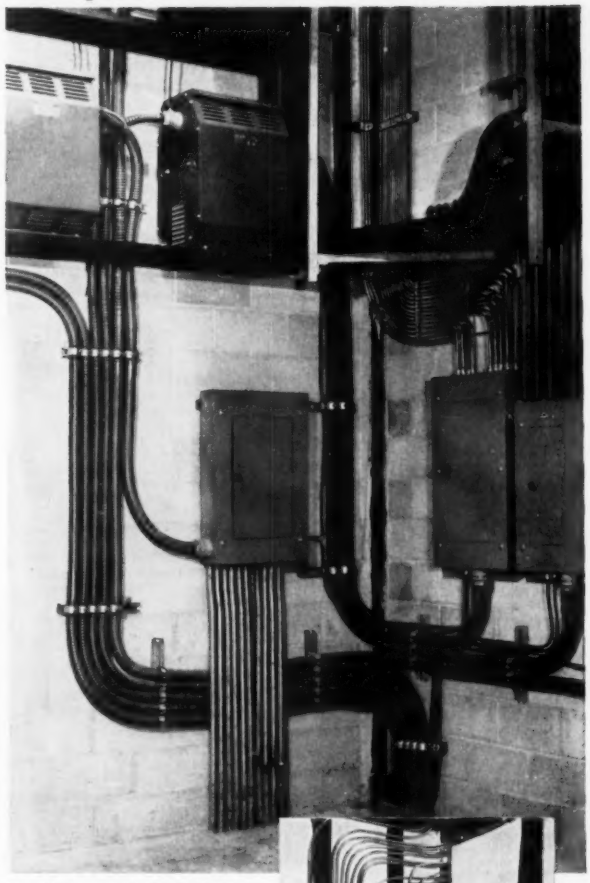
* * *

Your local Bell Telephone Business Office will be glad to help you with concealed wiring plans. For details on home telephone wiring, see Sweet's Light Construction File, 8i/Be. For commercial installations, Sweet's Architectural File, 32a/Be.

BELL TELEPHONE SYSTEM

the right combination for industrial power needs!

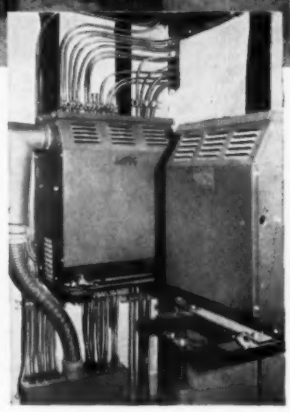
Only General Cable manufactures both...



Installation at the St. Regis Paper Company, Jacksonville, Fla. plant.

TYPE M.I. CABLE

for distribution, control and lighting circuits



INTERLOCKING ARMORED CABLE

for primary power feeder circuits

Easy to install in all locations, both Safety M I Cable and Interlocking Armored Cable require no mechanical protection, thus lowering costs of installation and minimizing space requirements. These constructions are easy to train around equipment or structural members, assuring the absolute minimum of interference, and present a neat, functional appearance. In addition, Safety M I Cable has unequalled physical and electrical properties: it is completely resistant to moisture, aging, nearly all chemicals, and operates at continuous high temperatures. For truly modern wiring in your plant, specify Safety M I Cable and Interlocking Armored Cable. And remember; only General Cable makes them both.

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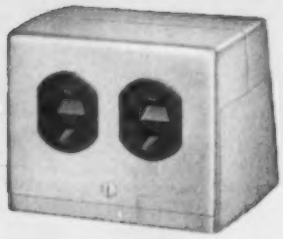
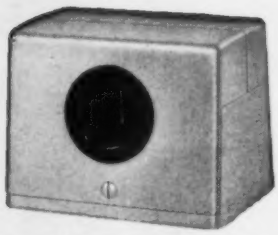
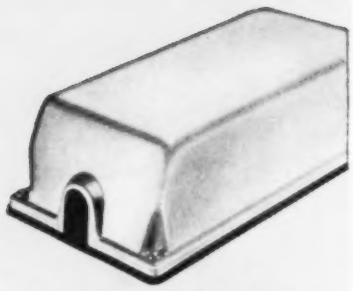
for quality and service... **specify GENERAL CABLE**



STANDARD POWER FITTING
Will accommodate all known receptacles up to 50 amps

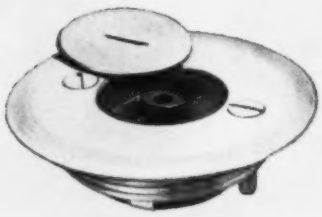


CUSTOM TELEPHONE FITTING
Will accommodate from one to three Western Electric 44-A terminal blocks

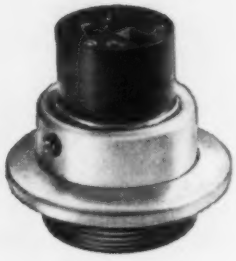


MULTIPLE TELEPHONE SERVICE FITTING
Will accommodate up to six Western Electric 44-A terminal blocks and one buzzer

ABANDONED OUTLET PLATE



FLUSH FLOOR SERVICE FITTING



STANDPIPE FITTING

THE BEST YOU CAN BUY!

SPANG SERVICE FITTINGS

NEWEST DESIGNS
All fittings are of engineered design to incorporate latest styling and easy-working features.

FAST INSTALLATION EASY ADJUSTMENT
Easy to wire. Extra-roomy design provides ample working area and space for excess wiring. Fittings adjust quickly into place.

COMPLETE LINE
There's a SPANG Service Fitting for every type outlet. Your choice of high-lustre brass or brushed aluminum.

INTERCHANGEABLE
SPANG Fittings are easily adapted to other underfloor duct systems. Exclusive SPANG Adapter assures fast installations.

LONG SERVICE LIFE
Once installed, SPANG Fittings can't twist or turn. Exclusive neoprene gasket seal makes fittings watertight.

MAKE SPANG YOUR FIRST CHOICE!
SPANG Standard Underfloor Duct and SPANG Industrial Duct for use with conventional slab construction, and SPANG Headerduct for use in cellular floor construction offer many time-saving advantages. Available through SPANG Distributors all across the country. Write for complete information.

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District Offices and Sales Representatives in Principal Cities

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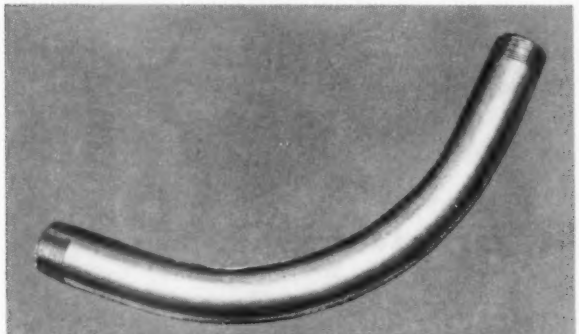
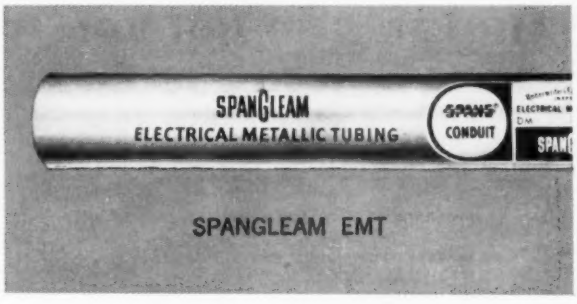
SPANG HD GALVANIZED CONDUIT

SPANG BLACK CONDUIT



SPANG HD GALVANIZED ELBOWS



SPANGLEAM EMT

THE BEST YOU CAN BUY!
SPANG CONDUIT AND FITTINGS

QUALITY-CONTROLLED MANUFACTURING

SPANG Conduit and Fittings are manufactured under close control to assure you of top-quality products.

TOP-QUALITY FINISH

Hot-dipped, black enamel or SPANGLEAM won't chip, peel or flake under severe bending strains. All couplings are electro-galvanized.

TESTED AND INSPECTED

Before shipping, a sample of each lot is carefully checked to be sure you get only the best!

EASY TO WORK WITH

Uniform throughout, SPANG Conduit cuts and bends easily, speeds installations, helps cut time costs.

LONG SERVICE LIFE

SPANG Conduit assures positive grounding, is highly resistant to corrosion, provides years of top-quality wiring protection.

MAKE SPANG YOUR FIRST CHOICE!

You'll get top quality every time . . . and keep installation costs down, too! Your nearby SPANG Distributor carries the complete line of SPANG Conduit and Fittings. He'll give you top-quality service on your order. If you're not a SPANG "regular," give SPANG a try. You'll like the results!

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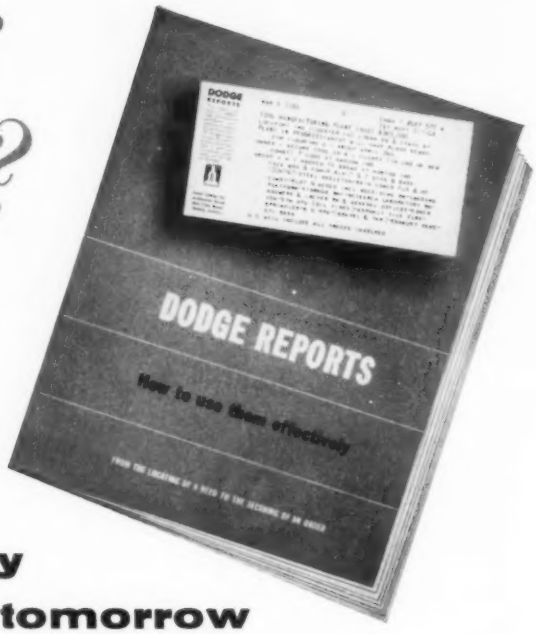
VISIT SPANG BOOTH 603

NAED Convention
June 8-12
San Francisco

looking for business?



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great names combine

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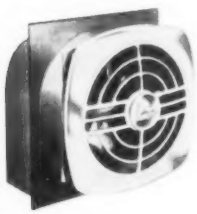
RESIDENTIAL VENTILATION

Axial FLO-FANS

Step up your residential exhaust fan sales with America's most popular low-cost exhaust ventilator . . . the exclusive Emerson-Pryne Axial Flo-Fan, with turbo-rotor blade action! Five basic models provide adequate ventilation in every type of installation. Sales-winning features include greater air delivery, quiet, maintenance-free operation and attractive appearance.

CEILING INSTALLATION Emerson-Pryne Axial Flo-Fans for ceiling installation are made in two sizes and three models. Wind-tunnel housings are equipped with special easy-set mounting brackets for easy installation without framing in. Built-in splice box makes electrical connection fast and easy.

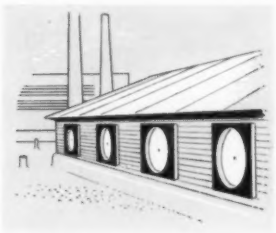


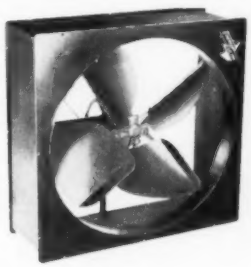
WALL INSTALLATION Axial Flo-Fans for sidewall installation offer the ideal solution to home ventilating problems where a wall fan can be used. Adjustable (with extensions) for wall thickness from 5″ to 20″, these fans are available in two sizes and three basic models. All models are furnished complete with weather-proof wall cap and built-in automatic damper to prevent backdrafts.

COMMERCIAL VENTILATION

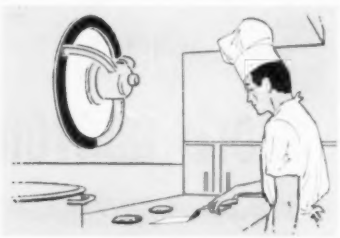
HEAVY DUTY EXHAUST FANS

Large volume air circulation to achieve effective cooling in offices, industrial plants, commercial and institutional buildings is assured with Emerson-Pryne *heavy-duty* exhaust fans. Low initial cost, easy installation and guaranteed, continuous-operating performance without costly call-backs mean extra satisfaction for your customer . . . extra profit for you.





BELT DRIVE Emerson-Pryne belt-drive exhaust fans, in a complete range of sizes from 24″ to 48″, provide for correct air delivery in all types of installations. Mounting flange on fan housing assures easy installation horizontally, vertically or at any angle. Capacitor-start, resilient-mounted motor has slotted base for adjustment of belt tension. Equipped with grease-packed ball bearings and welded steel frame for longer life . . . quieter operation.



DIRECT DRIVE Emerson-Pryne direct drive fans are built for heavy-duty, continuous operation. Welded steel frames, overlapping blade assemblies and ball-bearing construction assure quiet, efficient operation. Available in your choice of single-speed 12″ or two-speed 16″, 18″ or 24″ sizes. Motors are fully enclosed and self-cooling. Sturdy, ball-bearing construction permits installation at any angle.

World's leader in / EXHAUST FANS · EXHAUST BLOWERS · ATTIC FANS · AIR CIRCULATORS
KITCHEN HOODS · CEILING HEATERS · RECESSED LIGHTING FIXTURES

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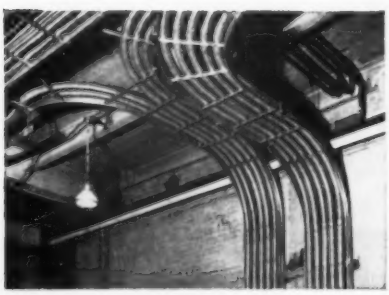
A DIVISION OF THE EMERSON ELECTRIC MFG. CO., ST. LOUIS, MO.

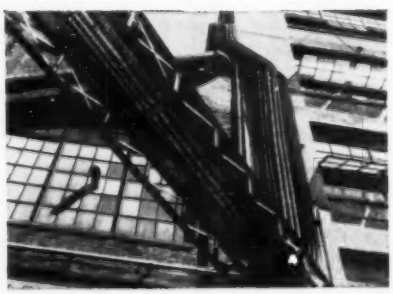
Count the

More convolutions per foot make National Electric



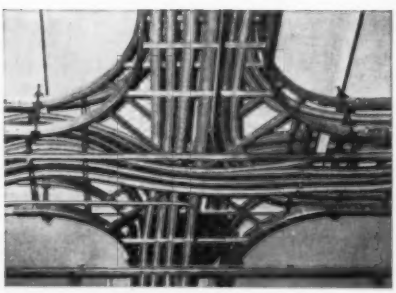
More convolutions mean greater flexibility

Bend Nepco-Lok around corners or projections indoors or out. Narrower steel strip used to make Nepco-Lok armor assures greater flexibility, speeds installation. Bondhook channel shape armor construction insures bonding and positive grounding.



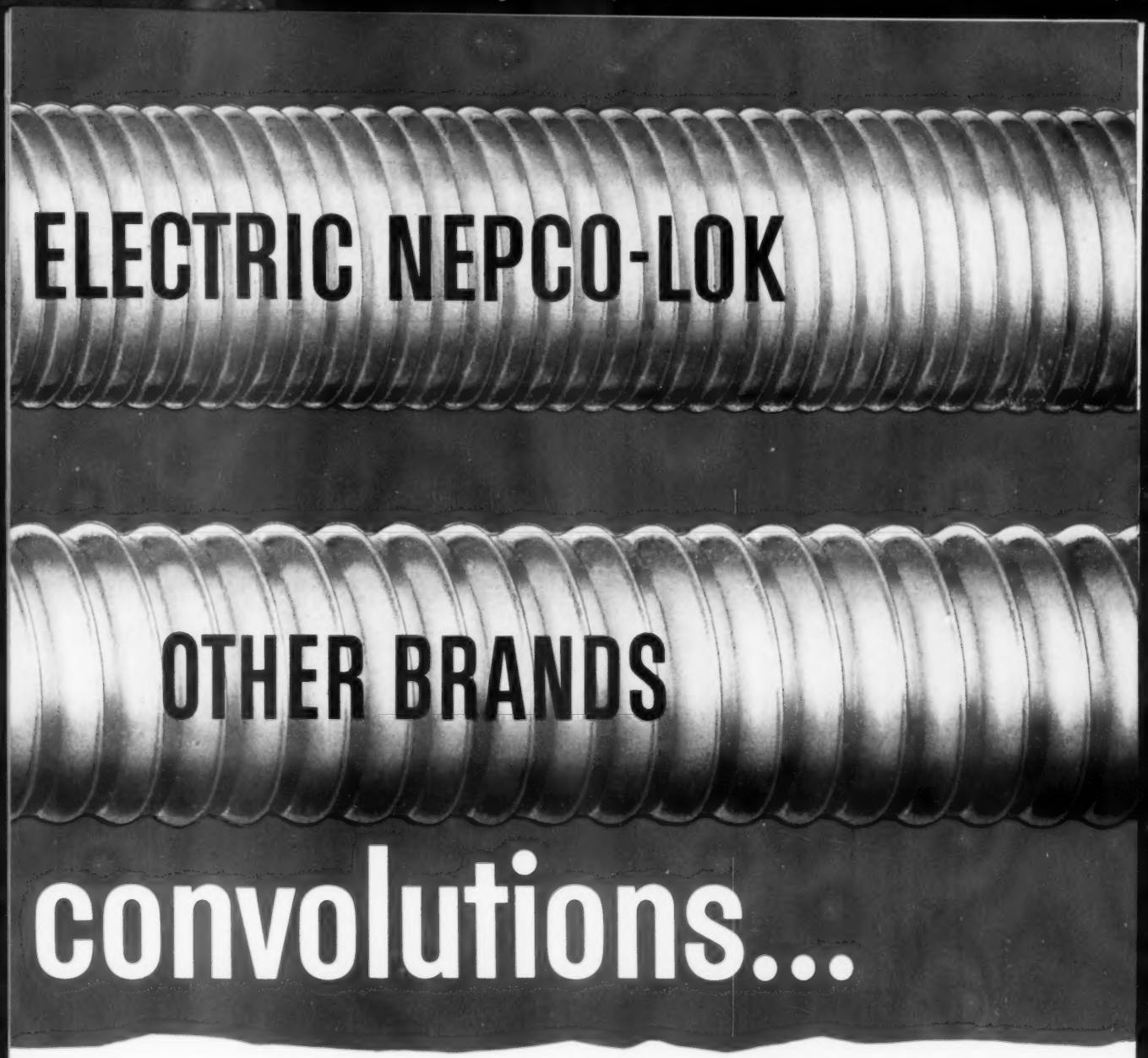
More convolutions mean fewer vertical supports

You reduce cost of vertical supports with Nepco-Lok. More convolutions mean more gripping surface for internal contact between cable and armor . . . reduces number of vertical supports needed per foot of cable.



More convolutions mean easier "pulling-in"

"Pull in" Nepco-Lok faster, easier. Reduced distance between raised convolutions provides a more uniform surface . . . reduces friction when Nepco-Lok is pulled into racks, saves installation time and cost.



Nepco-Lok the best buy in Interlocked Armor Cable

N.E. Nepco-Lok lets you get the most out of the big advantages of Interlocked Armor Cable Electrical Distribution

1. REDUCED INSTALLED COST
2. REDUCED WEIGHT
3. REDUCED SPACE REQUIREMENTS
4. REDUCED INSTALLATION TIME
5. REDUCED OUTAGE TIME

DON'T SAY ANY CABLE—SAY NE CABLE

NATIONAL ELECTRIC PRODUCTS
WIRING SYSTEMS
WIRES AND CABLES

National Electric Products

PITTSBURGH, PA.

2 Plants • 12 Warehouses • 41 Sales Offices

Panelboard planning

helps Power-Up State Office Building

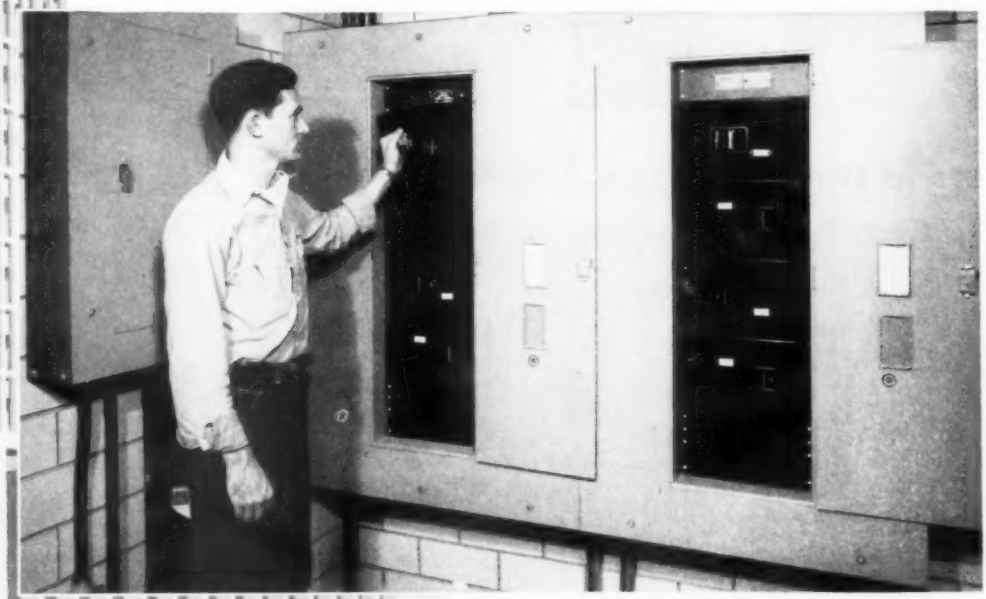
The new Commonwealth of Pennsylvania Office Building in Pittsburgh exemplifies the type of planning that powers-up today for future needs.

More than 40 Westinghouse Panelboards (Type NLAB & Type CDP) provide for lighting and distribution system protection and service continuity completely adequate for today's demands, and readily capable of expansion or modification to meet tomorrow's ever-increasing electrical needs.

OWNER—General State Authority, Commonwealth of Pennsylvania
ARCHITECT—Altenhof and Bown
CONSULTING ENGINEER—Carl J. Long
ELECTRICAL CONTRACTOR—E. C. Ernst, Inc.
WESTINGHOUSE DISTRIBUTOR—Keps Electric Company

J-93542

Westinghouse CDP Panelboards installed in the new State Office Building to provide protection and control of power circuits. Shown on wall at left is one of the Type NLAB Panelboards which protect building lighting circuits.



YOU CAN BE SURE...IF IT'S Westinghouse

"Off-the-shelf" delivery

— another example of how you benefit when you select American Blower ventilating equipment

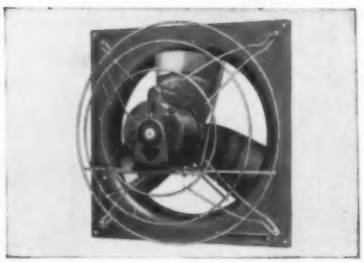
Efficiency-boosting ventilation practically sells itself; fast delivery *clinches* sales. So cash in now! Deliver quiet, efficient American Blower Ventura Fans "off-the-shelf" from *local* stocks, and watch profits increase!

Easy-to-install Ventura Fans move large volumes of air at low cost. They're designed to run quietly, and are competitively priced. Compact and attractive, Ventura Fans offer customers:

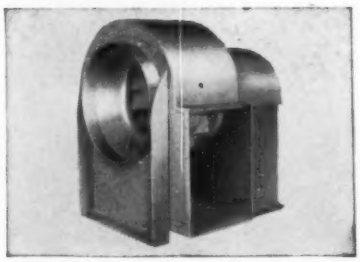
- **Packaged ventilation** – Complete, ready to use. Fast, economical installation.
- **Pre-engineering** – Each model handles a wide range of capacities. Just pick proper fan directly from the catalog. No on-the-job engineering needed.
- **Certified Ratings**—Air deliveries meet rigid standard test codes.

For *extra* profits, sell the *complete* line of American Blower fans for every ventilating job. Sales help: equipment selection assistance from one of our 73 branch offices. Write for facts today! American-Standard,* American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

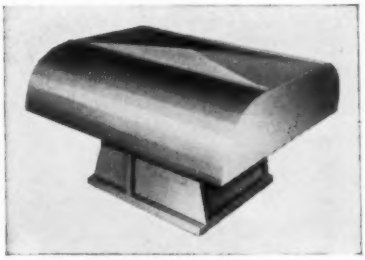
It pays to standardize on American Blower!



Ventura Fans – quiet, efficient, economical. Sizes from 10" to 30".



Utility Sets – direct drive, sizes 3" to 12¼"; V-belt drive, 9" to 36".



Power Roof Ventilators – available through American Blower branches.

* American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
AMERICAN BLOWER DIVISION

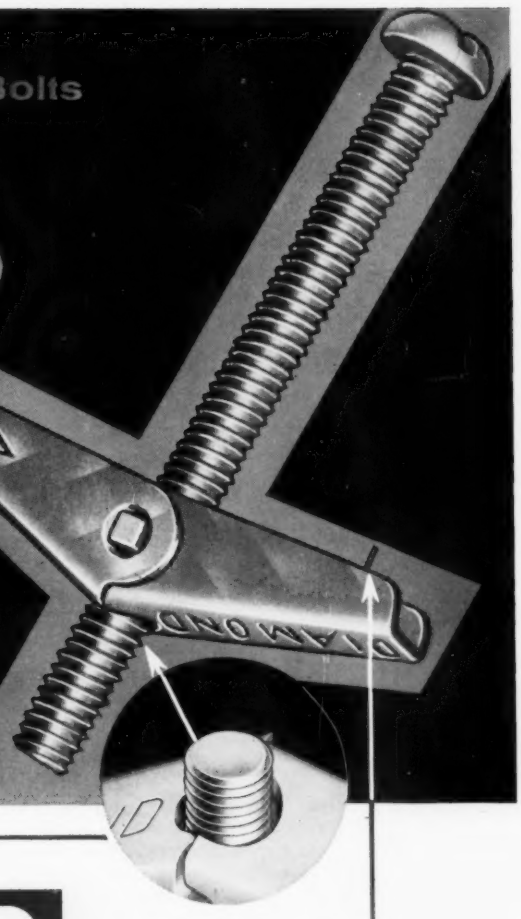
DIAMOND Spring Toggle Bolts

THESE

TWO

EXCLUSIVE DIAMOND FEATURES

guaranteed faster work, greater holding power



1

Patented Feature – Wings butt together forming a truss rather than bearing against the bolt and permit easy tightening even under load.

2

Wings hold at set angle. A special anti-turning prong on one wing allows you to position wings at any horizontal or vertical angle and prevents wings from turning with bolt during installation. Saves time, tempers.

Other DIAMOND Quality Features

- bright zinc plating, corrosion and rust resistant.
- entire length of bolt is threaded for use on thick or thin walls.
- choice of bolt heads; round, flat and, in popular sizes, mushroom.
- wide range of diameters, ⅛" to ½", lengths up to 6".
- packed in strong metal edge boxes, 50 to box all sizes except ⅜" and ½" which are packed 25 to box.
- other lengths and different heads available on special order.

Order Diamond Spring Toggle Bolts from your electrical supply distributor. He offers complete stocks, fast service.

Diamond Spring Toggle Bolts assure maximum strength, easiest installation. With Diamond Toggle Bolts — *you're sure it's secure!*

Complete information and specification on Diamond Spring Toggle Bolts is contained in illustrated Bulletin No. 7001. *Write today* for your free copy.

DIAMOND EXPANSION BOLT CO., INC.

500 North Avenue • Garwood, New Jersey

Stocking Warehouses: Atlanta, Boston, Chicago, Dallas, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Seattle, St. Louis, Washington, D.C. Also, Montreal, Toronto and Vancouver, Canada.

ECON® DUAL-ELEMENT FUSES

INSTANTANEOUS ACTION ON SHORT CIRCUITS
The fusible links open the circuit immediately when a dangerous short develops. The multiple restricted fusing areas cause the heavier sections to drop out in metallic form completely severing the circuit.
TIMED DELAY ON MOMENTARY OR HARMLESS OVERLOADS
Exclusive Econ Alloy thermal element takes harmless overloads up to 500% . . . gives predetermined delay action to avoid unnecessary and costly fuse blows.
IT'S THE EXCLUSIVE ACTION IN ECON'S SUPER SAFETY ZONE that makes the important difference
NO INTERMEDIATE PLASTIC STAGE
When an overload exceeds the predetermined heat and time limits, Econ Alloy reacts instantaneously . . . changing directly from solid to liquid. The usual intermediate plastic stage is completely eliminated. Protecting action is fast and complete with Econ's Super Safety Zone.

with the exclusive Super Safety Zone

- STOP NEEDLESS FUSE BLOWS
- MINIMIZE COSTLY DOWNTIME
- ECON SAVES MONEY ON FUSING
- EXTRA PROTECTION AGAINST BURNOUTS

In Econ's Super Safety Zone you'll find an important difference in action . . . a money saving . . . circuit protecting action that spells lowered costs all down the line.

In this Super Safety Zone, harmless or temporary overloads are carried through an exclusive Econ Alloy Element which delays blowing to a predetermined time limit. When overloads exceed the time limit, Econ Alloy breaks the circuit with fast action. This Super Safety feature costs you nothing extra...Another good reason why it's always extra economy to insist on ECONOMY Fuses.

Available in knife blade or ferrule type from 0 to 600 amperes, 250 and 600 volts. Underwriters' Laboratories listed.

Write for ECON Dual-Element Catalog S-60.

it's always extra economy to call for

ECONOMY FUSES

ECONOMY FUSE AND MFG. CO.
2717 Greenview Avenue, Chicago 14, Illinois

291

ASK YOUR ELECTRICAL WHOLESALER FOR ECONOMY FUSES . . . THE COMPLETE FUSE LINE

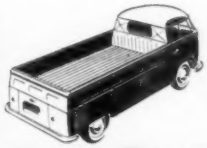
SENSIBLE · HONEST · DEPENDABLE

VOLKSWAGEN PANEL DELIVERY

...and ECONOMICAL

Volkswagen Light Trucks have all these virtues... outstanding gas economy... air-cooled engine... no radiator problems... sturdy construction that takes the bumps of rough terrain. Volkswagen has unusual visibility and ease of driving and parking. The Volkswagen Panel Delivery gives electrical contractors a whopping big 170 cu. ft. of usable storage space. It loads from wide side doors, as well as the rear loading door. You can install a complete test shop inside... save time- and dollar-wasting trips. Top and sides... front and rear give you a bonus in free space for distinctive advertising. But above all, remember: *a Volkswagen costs less to buy, run and maintain.* This we can prove! Sales and Service in 48 states. Look for the Authorized Volkswagen Dealer with this VW emblem.

VOLKSWAGEN DELIVERS THE GOODS . . . FOR LESS!



PICK-UP—1764-lb. payload ...45 sq. ft. floor area plus 20 sq. ft. in a lockable weather-tight compartment underneath. Sides and back drop down for easy loading.

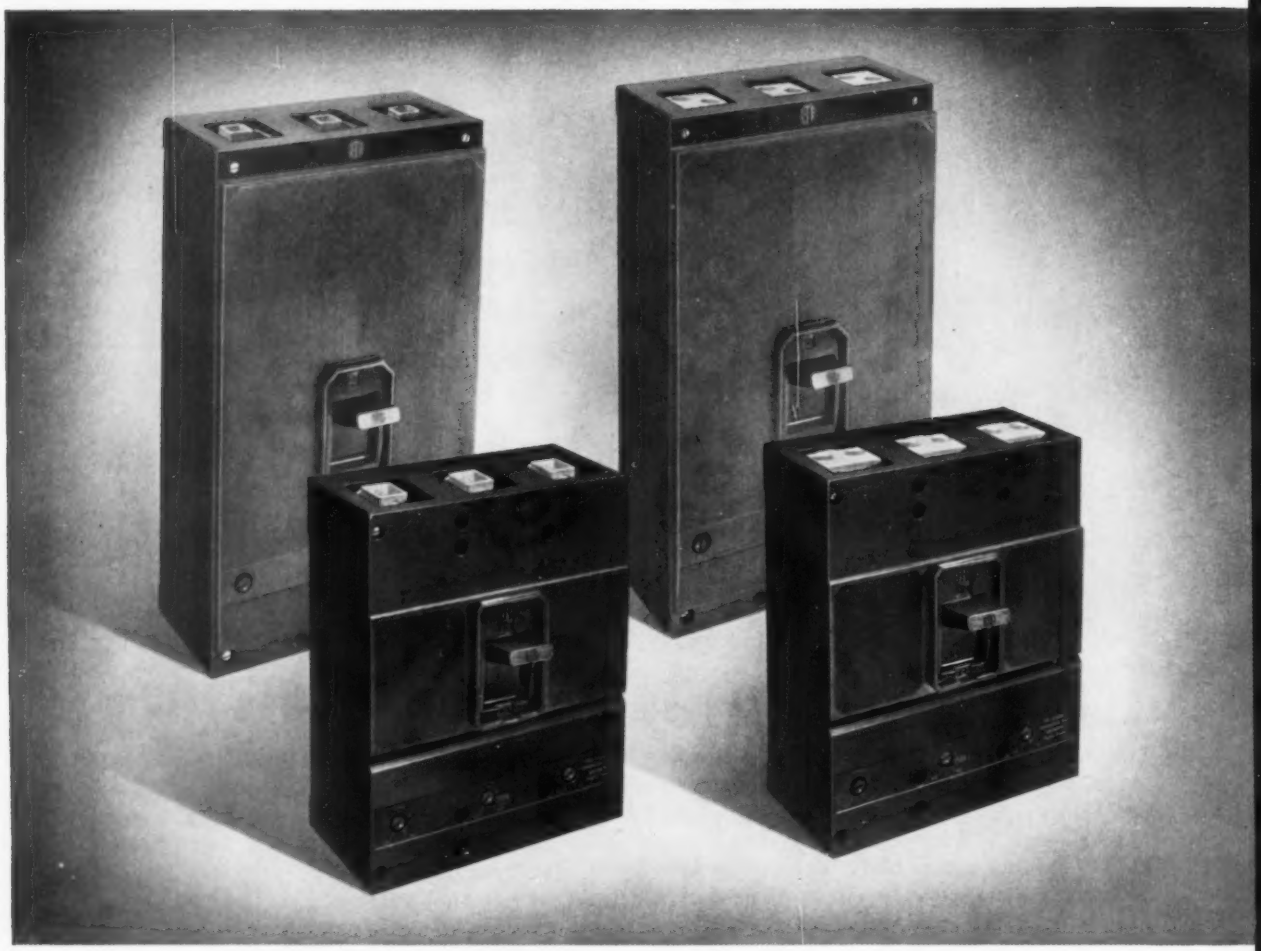
KOMBI—it's even more than a Panel Delivery. It converts into a comfortable station wagon in minutes ... just by putting the seats back in.

VOLKSWAGEN

Announcing

TWO NEW I-T-E Molded

New, compact JK and JKL molded case circuit breakers are the two latest additions to industry's most complete and diversified line

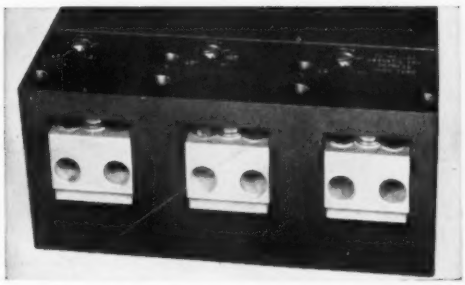


SPECIFICATIONS

	Continuous Rating	Interchangeable Trip Unit	Interrupting Rating	Front-removable lugs	Dimensions
JK	70-225 amp	yes	(at 600 v) 25,000 amp (at 240 v) 30,000 amp	yes	9 x 11 x 4 1/16 in.
JKL	125-400 amp	yes	(at 600 v) 25,000 amp (at 240 v) 40,000 amp	yes	9 x 11 x 4 1/16 in.

Case Circuit Breakers!

- **Interchangeable trip unit construction**
- **225 and 400 amp continuous ratings**
- **25,000 amp interrupting ratings**
- **Exclusive new front-removal lug design**



I-T-E Molded Case Circuit Breakers have exclusive, completely enclosed terminals for greater safety.

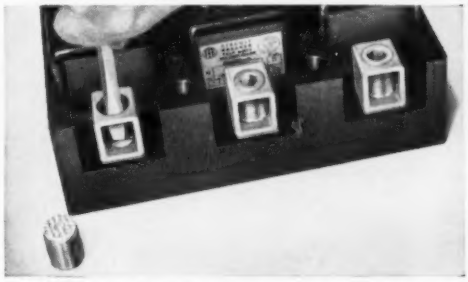
...in a size only two-thirds that of breakers previously required

As one of the pioneers in the electric circuit breaker field, I-T-E has consistently maintained its leadership—not only in developing new products to meet the growing needs of industry, but in constantly seeking ways to improve existing designs.

The new JK and JKL I-T-E Molded Case Circuit Breakers are but one more example of I-T-E advances in the interest of continued improvement. They have the same famous built-in I-T-E "extra quality—at no extra cost."

These new JK and JKL breakers are identical—performance-wise—with existing K and KL breakers, and not only do they represent space economy, but in certain instances an actual saving in initial cost. Compare with any other equally rated breaker.

See your I-T-E distributor for details on these new breakers or write I-T-E Circuit Breaker Company, Small Air Circuit Breaker Division, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada, Eastern Power Devices Ltd., Port Credit, Ontario.



New I-T-E JK and JKL breakers have an exclusive lug which is installed from the front of the breaker. This assures easy interchange of trip units when the breaker is in place.

I-T-E JK and JKL frame breakers provide external front adjustable instantaneous trip design, an I-T-E exclusive.

I-T-E CIRCUIT BREAKER COMPANY
PHILADELPHIA, PENNSYLVANIA

"Glare-less" Lighting with Mercury Uplight Units
Abolite's 24" wide Alzak aluminum uplight fixtures used with H 400-RC1 mercury lamps. Ceiling height is 35'; fixture height, 27' 10", with 20' spacing. 90% of lamp's lumens are useful. Average footcandle level is 35.

Now Abolite brings "office type" eye comfort to...

INDUSTRIAL HIGH BAY LIGHTING

Abolite open-top units direct only a small amount of light (18%) upward, but it makes a big difference in eye comfort. Dark ceiling shadows are washed away—there's no sharp contrast of bright light against black background. And glare is reduced still more by 35° lamp shielding. As a result, eye fatigue is reduced—workers are more efficient.

Abolite's modern air-swept design also reduces maintenance costs because air circulating through the fixture sweeps it clean of dulling dust.

There are three Abolite uplight units for high bay lighting: 18" and 24" diameter Alzak aluminum fixtures for use with 400 and 1000 watt mercury lamps and 18" Alzak aluminum fixtures for 500 watt incandescent lamps (ideal for gymnasium lighting). For full information on these units, see Sweet's Industrial Construction File, 12i/AB.

ABOLITE Lighting

THE JONES METAL PRODUCTS COMPANY
West Lafayette, Ohio

No. 6 in a series

Right off the Wire

A computer-controller system is said to be capable of landing 120 jet planes per hour. Human control can average no better than 40 per hour.

Dockside facilities at SIMPLEX' Submarine Cable Division in Newington, N. H. are extensive enough to continuously load two of the largest submarine cable ships simultaneously.

A new plant is reported to cut the manufacturing time of industrial carbon components from eight weeks to eight minutes.

A "building block" technique, using miniature plug-in units, makes it possible to build an electronic computer small enough to go on an office desk.

An iron-aluminum alloy has been made, the behavior of which indicates that there is a relationship between rusting and magnetism.

Some fruit trees have been found to ripen earlier after long exposure to gamma radiation.

At least one of the new "exotic" rocket fuels is being made in solid form and others are expected soon.

A patent has been issued for a radioactive "go-devil" (a device for cleaning pipe lines). If it sticks in a pipe it can be located with a Geiger counter.

It is estimated that malicious damage to street lamps costs New York City a quarter of a million dollars a year. A new plexiglas globe makes this sort of vandalism almost impossible.

Instead of the usual bracing and shoring, inflatable cushions are being used to wedge freight tightly in box cars.

One of the new guided missiles is launched from an automatic base which computes the location of the attacking object, calculates its speed and the proper point for meeting it. It also loads and fires the missile automatically.

A micro-porous synthetic material holds a liquid, such as an ink or lubricant, and gives it off at a controlled rate.

Damage to small delicate parts on a conveyor can be avoided by a new belt that uses permanent magnets to hold the pieces apart.

Glass-reinforced plastics can be strengthened by the use of a special new glass containing copper oxide.

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

A new wool-like synthetic fiber is water-repellent, quick-drying and less expensive than other synthetics.

A device for measuring the power output of a turbine involves an inner and an outer gear in constant mesh with free space between the teeth. This space is filled with oil on which the pressure can be measured.

Simplex Wire & Cable Co. was the first to adapt interlocked armor (CONDEX) for use with underground cable in 1924.

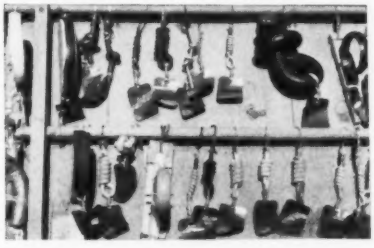
A logging company is using plastic nails to fasten logs together. They neither rust nor damage saw blades.

Paralyzed fingers can be made to move by means of tiny artificial muscles powered by a carbon dioxide cartridge.

Research conducted by two Simplex scientists in the early 1920's resulted in the first truly moisture-resistant rubber insulation. The isolation and removal of the proteins that are always present in natural rubber was the basis of the now famous ANHYDREX family of insulations.

Foamed aluminum is being made for use as a core in sandwich construction.

An electronic device checks the accuracy of aircraft guns without firing them.



Rooftop Laboratory

These cable samples, twisted and bent to exert maximum stress on insulations and jackets, are undergoing sun-crack endurance tests atop the Simplex plant at Cambridge. Many of these samples have been exposed to the elements for as long as fifteen years . . . and they haven't cracked yet. This is one example of the many punishing tests which Simplex insulating and jacketing compounds, such as Anhydrex, Thermoplex and polyethylene, are subjected to before they win final approval.

It's all part of a comprehensive system of quality control which has helped make Simplex the leader in cable research and manufacture.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

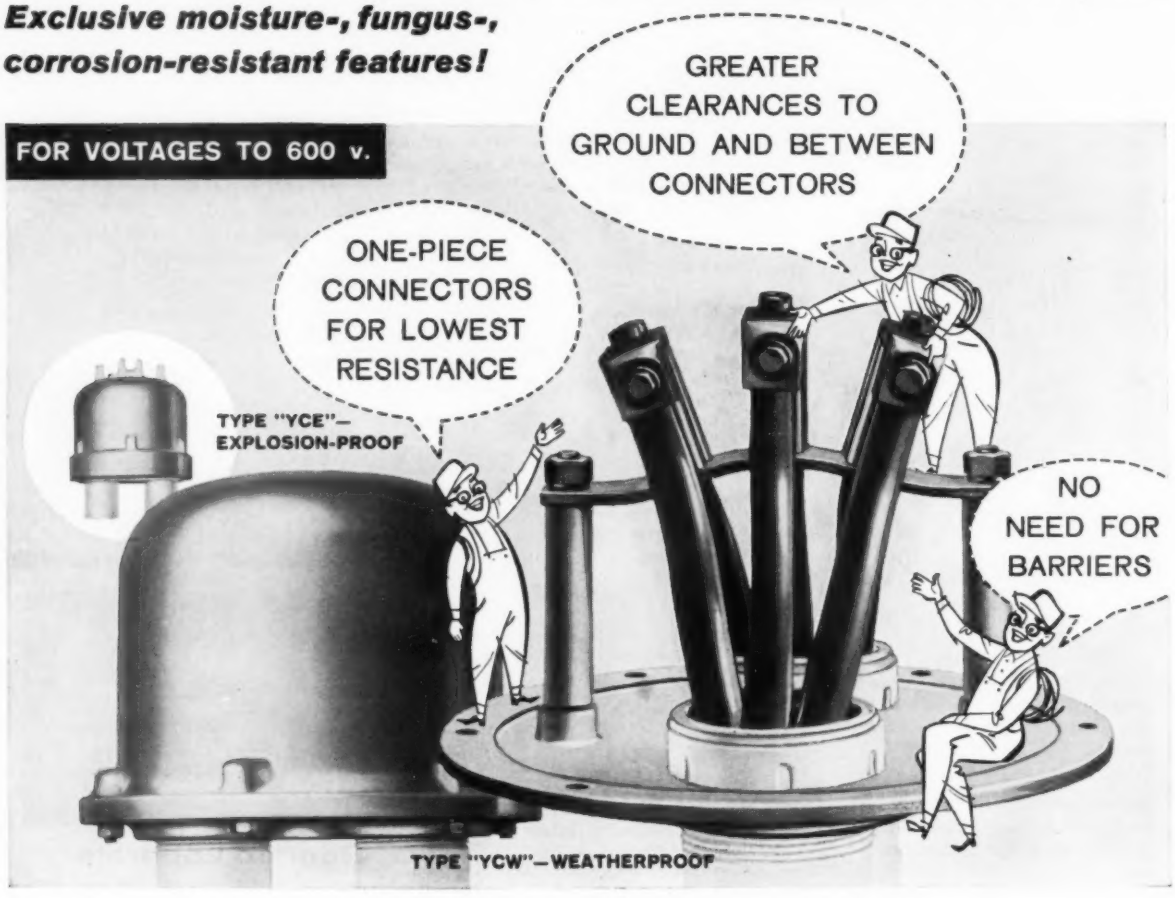
Simplex

"The American manufacturers of transoceanic telephone cables"

NEW! O.Z. PULL-N-SPLICE BOXES!
CONVENIENT · COMPACT · ECONOMICAL

Exclusive moisture-, fungus-, corrosion-resistant features!

FOR VOLTAGES TO 600 v.


GREATER CLEARANCES TO GROUND AND BETWEEN CONNECTORS
ONE-PIECE CONNECTORS FOR LOWEST RESISTANCE
TYPE "YCE"— EXPLOSION-PROOF
NO NEED FOR BARRIERS
TYPE "YCW"—WEATHERPROOF

O.Z. Pull-n-Splice Boxes mark a significant advance in pull box construction!

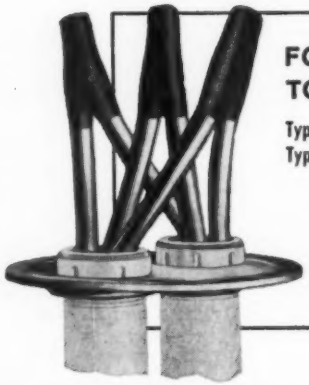
Their highly compact size saves *more space than ever!*

Their more efficient design means *new savings in installation time and labor!*

Their moisture-, fungus-, and corrosion-resistan. features mean long, trouble-free service.

Still, with all their features, the new O.Z. Pull-n-Splice Boxes are *smaller* — and *cost far less* than conventional pull boxes . . . even late model *competitive* types! And, you get a bonus in high quality materials and workmanship so characteristic of *all* O.Z. products!

For complete information on these and the many other O.Z. products that mean more for you, call your local O.Z. distributor, or write to the company.



FOR VOLTAGES TO 5000 v.

Type "YPW" — Weatherproof
Type "YPE" — Explosion-proof

Deeper dome than "YCW" and "YCE". Furnished without connector panels. Insulated pigtail splices recommended.

O.Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND STREET • BROOKLYN 17, N. Y.

- CAST IRON BOXES
- CABLE TERMINATORS
- POWER CONNECTORS
- SOLDERLESS CONNECTORS
- GROUNDING DEVICES
- CONDUIT FITTINGS
- INTERLOCKED ARMOR CABLE FITTINGS

Sales Office and Warehouse: 406 So. Cicero Avenue, Chicago 44, Ill. • ESterbrook 9-0326
Office and Factory: 749 Bryant Street, San Francisco 7, Calif. • GArfield 1-7846

NEW YORK'S COLISEUM USES

ALLEN-BRADLEY

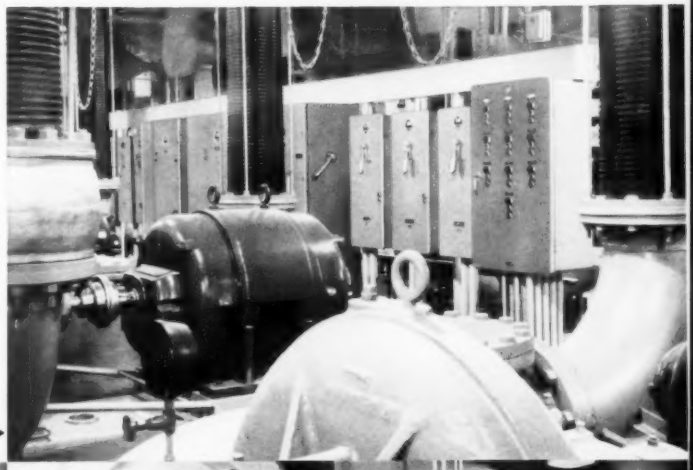
TROUBLE FREE MOTOR CONTROL

Owner: Triborough Bridge and Tunnel Authority
Heating, Ventilating, and Air Conditioning Contractor: Almirall & Co., Inc.
Engineer: Guy B. Panero
Architects: Leon & Lionel Levy

More and more buildings—like the huge New York Coliseum—are being equipped with Allen-Bradley motor control.

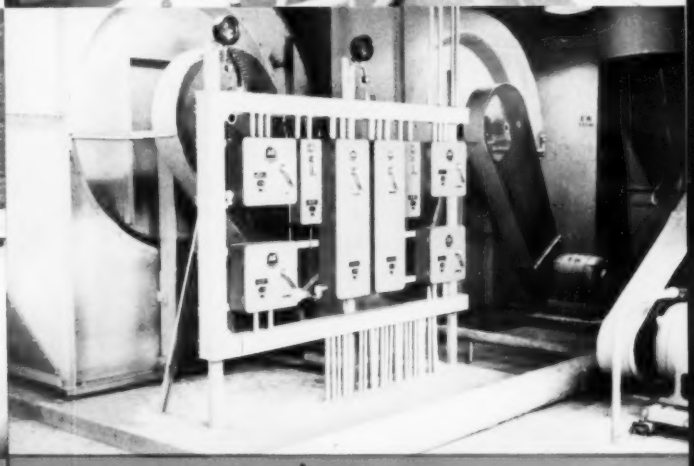
Reliability is the basis for their selection. The simple solenoid—around which all Allen-Bradley motor starters, contactors, and relays are built—has only ONE moving part. This assures millions of trouble free operations. Also, *all* Allen-Bradley magnetic motor control is provided with double break, silver alloy contacts, and contact maintenance is eliminated. These contacts remain in perfect operating condition until completely worn away. The overload relays dependably protect the motor—no matter how long installed nor under what atmospheric conditions they must operate.

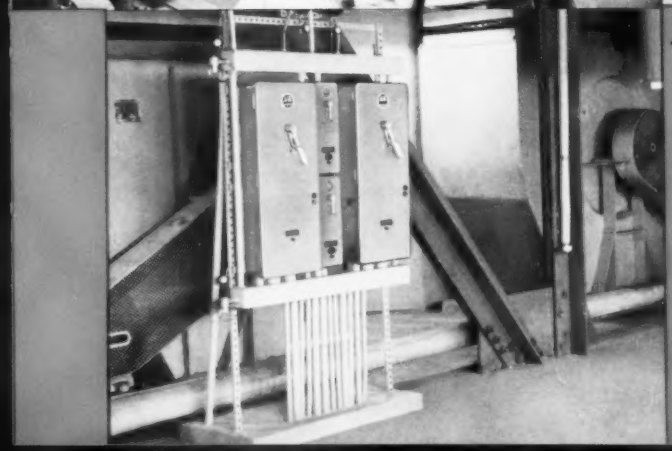
Specify Allen-Bradley—the motor control you can install . . . and forget! Send for catalog, today.



Bulletin 740 reduced voltage and Bulletin 712 combination starters for chilled water and condenser pumps. ▶

Bulletin 712 combination starters for booster and condenser water pumps. ▼





◀ Bulletin 712 combination starters, Size 1 and Size 4, mounted in fan room.

▲ This fan room control panel uses eight Bulletin 712 combination starters—including Sizes 1, 2, and 3.

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

8-58-M

Built to ALLEN-BRADLEY Quality STANDARDS!

A-B Control Centers are popular because of their...

Quality Appearance

Quality Construction

A-B QUALITY

BULLETIN 798 Multi-Unit Control Centers

With control centers more than with individual starters, the appearance is often very important—frequently the control center is used as a "show" installation. The "Quality" built into Allen-Bradley Control Centers cannot be beat—it is a "plus" value which you obtain without extra cost.

Naturally, the installation of an Allen-Bradley Control Center provides additional values—such as those outlined below.

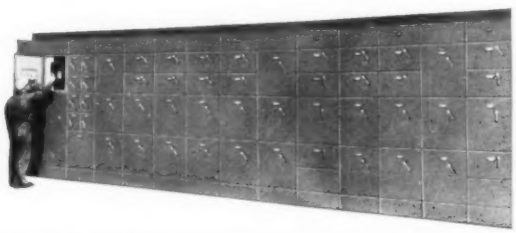
ADAPTABLE TO PLANT CHANGES—Entire units can be moved or complete sections can be added to meet plant changes without the need for changing the internal wiring of the control center.

GREATER SAFETY—Centralized control and locked operating handles prevent tampering by unauthorized personnel. Panels have "dead front" construction with buses and wiring completely enclosed.

MODERN APPEARANCE—This neat, compact installation eliminates the unsightly supporting structures of individually mounted starters and the numerous conduits between separate starters.

LOWER OVER-ALL COST—A-B Control Centers arrive wired and tested. Installation cost is a fraction of that for individual starters. Standardized units eliminate custom engineering.

With Allen-Bradley plug-in type units, starters can be added or removed from the section without disconnecting the rest of the control center from the line.



The long and short of it. A-B Control Centers consist of any number of vertical sections assembled into one unit.

ALLEN-BRADLEY COMPANY

1316 S. Second St., Milwaukee 4, Wis.

In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

8-58-M

News about

B.F.Goodrich Chemical *raw materials*

Sanford station of Florida Power & Light Company uses Geon conduit furnished by Hughes Supply of Daytona Beach. B.F.Goodrich Chemical Company supplies the Geon polyvinyl material only.

corrosion problem knocked out . . .

generating station gets conduit of Geon

YEARS from now pulling new cable through this conduit made from Geon polyvinyl materials will be just as easy as it is today. Unlike ordinary steel conduit, Geon conduit resists the corrosive effect of salt water, gases, chemicals and acid or alkaline soils. Internal and external surfaces stay smooth—like new.

Conduit or pipe made from Geon offers high tensile or impact strength. It stands up under pressure . . . is not subject to galvanic corrosion. It resists sunlight, fungi, bacteria, moisture, heat and cold. And its light weight makes installation especially easy.

Engineers are taking advantage of properties of pipe and conduit of Geon in a wide variety of applications. For information, write Dept. LS-3, B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich

GEON polyvinyl materials • HYCAR American rubber and latex
GOOD-RITE chemicals and plasticizers • HARMON colors

SPECIFY QUALITY . .

insist on *Levolier*® switches

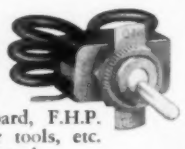
Only McGILL makes *Levolier*® switches

— and only Levolier switches give you the degree of quality that has earned them the reputation of being the most dependable switches ever built. Material selected for extra quality includes heavy special alloy copper or silver for contacts and all switches are pre-lubricated with highly refined plastic petroleum. Completed switches are 100% factory tested and eliminate costly replacement.

Levolier switches are designed for fast, economical installation with self-insulating molded phenolic cases. .75 to 20 amps. All are Underwriters Laboratories Inspected.

No. 71 single-pole single circuit, universal pull lever switch . . . the thinnest 6 amp. "T" 125 volt—3 amp. 250 volt switch of its kind on the market today—only 15/32" thick. Also with push button.

No. 1010 single-pole, single circuit lever switch for high-watt lamps and fluorescent banks. Universal pull lever control. 10 amp. 125 volt.



No. 25 toggle switch carries a 6 amp. "T", 125 volt, 3 amp., 250 volt rating with a S. P. S. T. double-break mechanism. 1/3 H.P. A.C. 120-240 volt. Ideal for panel board, F.H.P. motors, appliances, power tools, etc. Also with push button control.

No. 90 ¾ H.P. capacity, 15 amp. 125 volt, 10 amp. 250 volt toggle switch with a single-pole, single-throw mechanism. Designed for AC operation. Also available in two circuit with center off and no off.

No. 29 single-circuit, .75 amp., 125 volt momentary contact switch. Excellent for automatic control of lights as in door openings and closings. Also 4 amp. Available 15 amp., for limit and safety control of industrial machinery operations.

No. 41 single-pole, single-circuit, universal lever switch. 6 amp. "T", 125 volt—3 amp. 250 volt. Only ⅝" thick, it is ideal for conduit box and canopy mounting for lighting and for FHP motor control.

FREE! For complete details on McGill switches, sockets, lampguards and other electrical specialties, write for catalog #84.

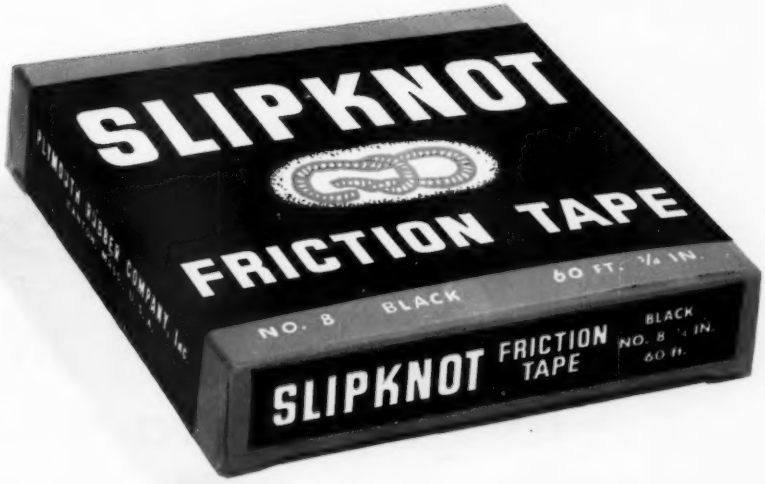
Available from your electrical wholesaler.

McGILL®
ELECTRICAL SPECIALTIES

are always a little better and ***ALL*** *are Underwriters Laboratories Inspected*

McGILL MANUFACTURING COMPANY, INC. **450 N. Campbell St., Valparaiso, Indiana**

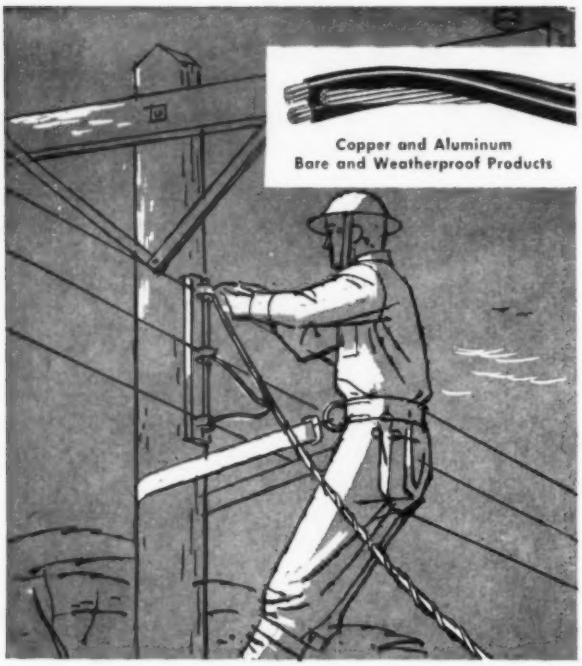
Found in all the Best Splices



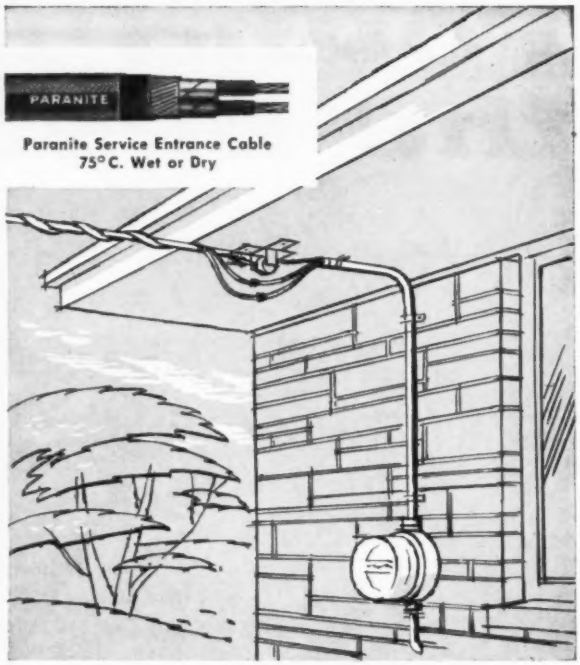
With the only practical on-the-job tape cutter in the industry — FREE

PLYMOUTH RUBBER COMPANY, INC.

DIVISION 15 CANTON, MASSACHUSETTS



Copper and Aluminum
Bare and Weatherproof Products



Paranite Service Entrance Cable
75°C. Wet or Dry

From Source to Service with ®

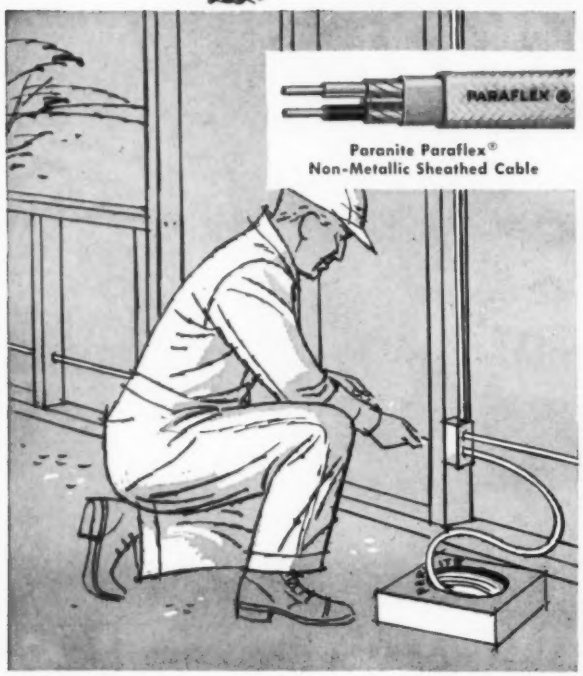
PARANITE

PARANITE WIRE AND CABLE DIVISION

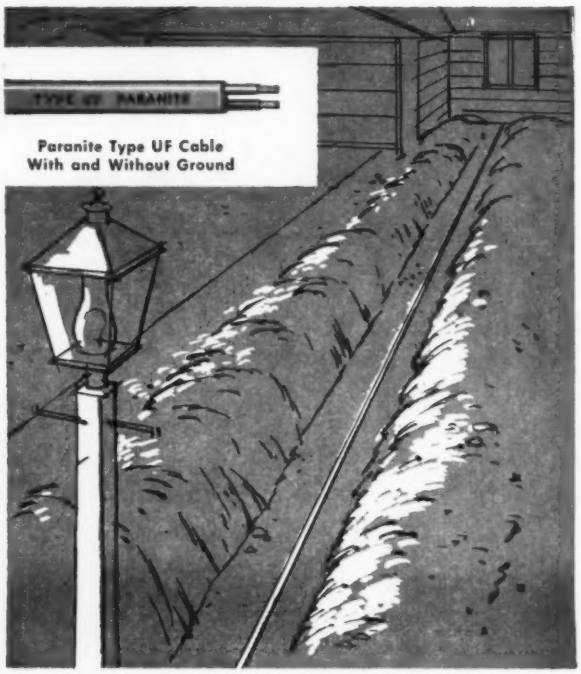
Essex Wire Corporation

FORT WAYNE 6, INDIANA

MANUFACTURING PLANTS: Birmingham, Alabama; Anaheim, California; Jonesboro, Indiana; Marion, Indiana; Tiffin, Ohio

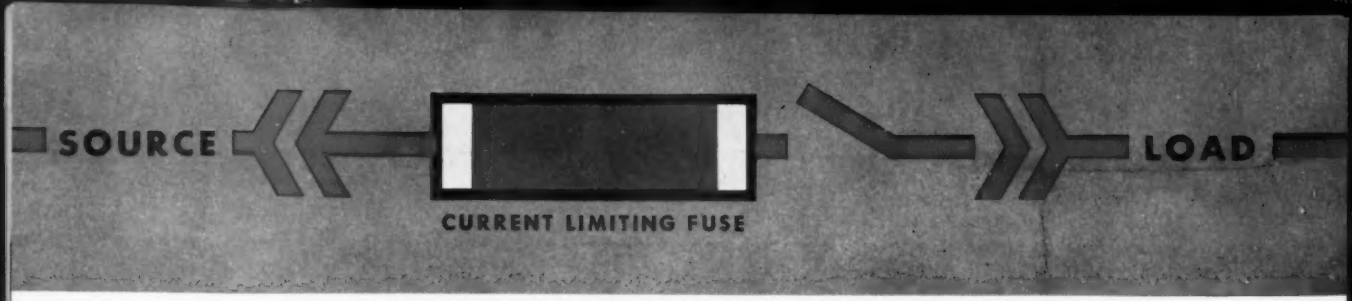


Paranite Paraflex®
Non-Metallic Sheathed Cable



Paranite Type UF Cable
With and Without Ground

Sales Offices in all Principal Cities . . . Sold only through Recognized Electrical Distributors



CURRENT LIMITING FUSE ON *SOURCE* SIDE OF SWITCH FOR SHORT-CIRCUIT PROTECTION

Improved protection with

General Electric ROLLOUT

Switch and Fuse Equipment

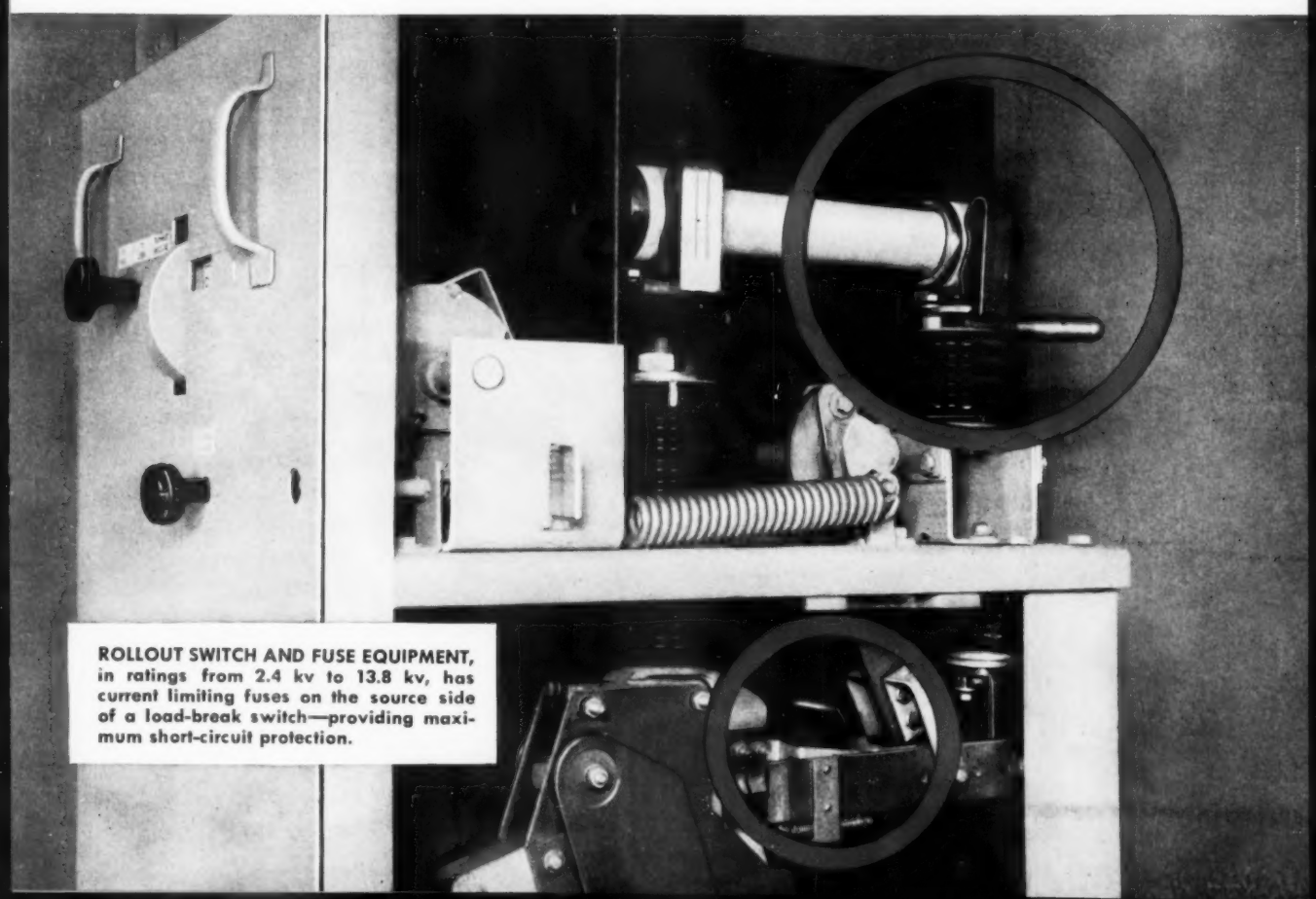
You get improved short-circuit protection with General Electric's new Rollout Switch and Fuse Equipment—because current limiting fuses are placed on the *source* side of a load-break switch.

You also get greater safety, easier maintenance and inspection, and installation versatility—with the new equipment's rollout feature.

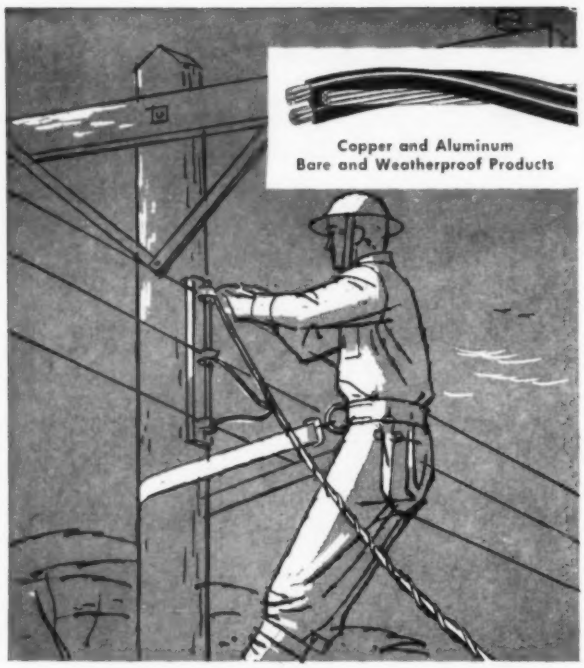
Call your nearest General Electric Apparatus Sales Office for more information or write for Bulletin GEA-6623, General Electric Company, Section F-514-3, Schenectady, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC



ROLLOUT SWITCH AND FUSE EQUIPMENT, in ratings from 2.4 kv to 13.8 kv, has current limiting fuses on the source side of a load-break switch—providing maximum short-circuit protection.



Copper and Aluminum
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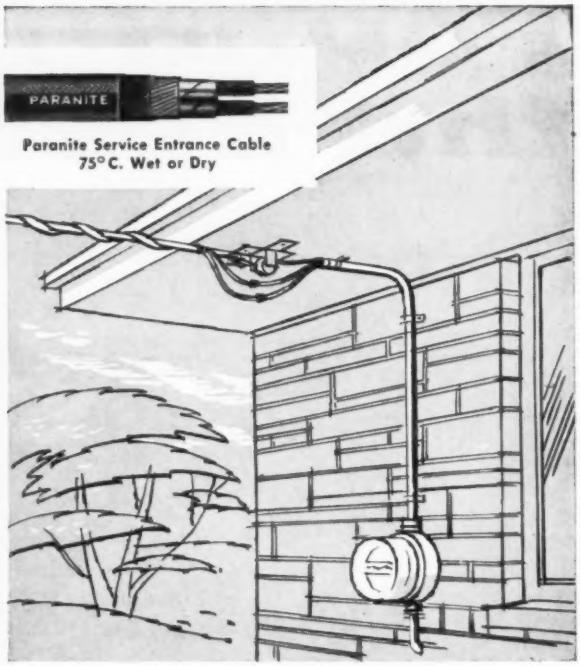

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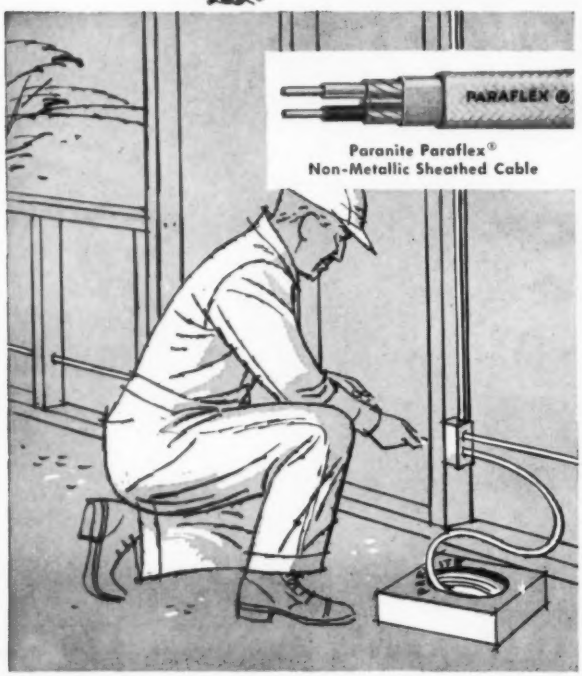

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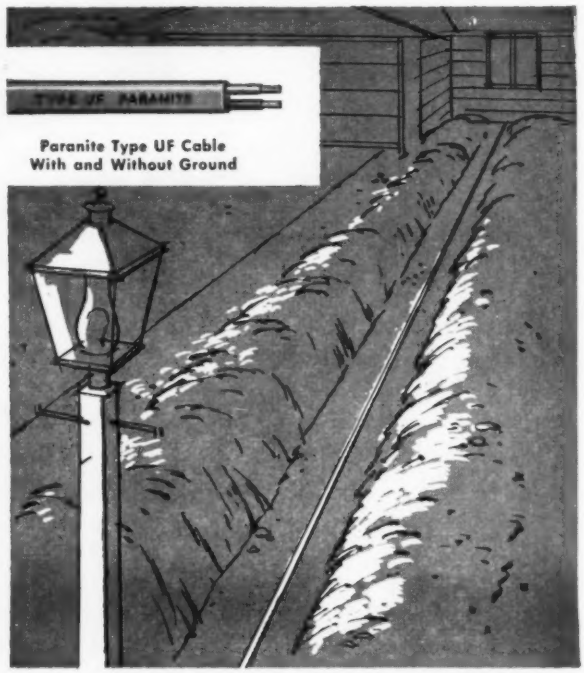

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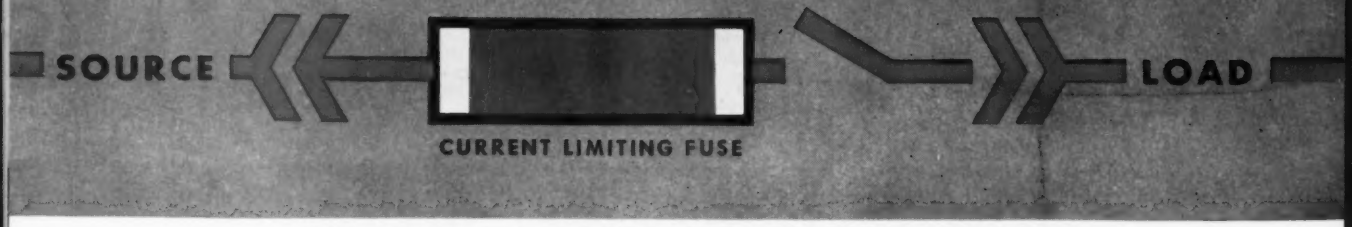

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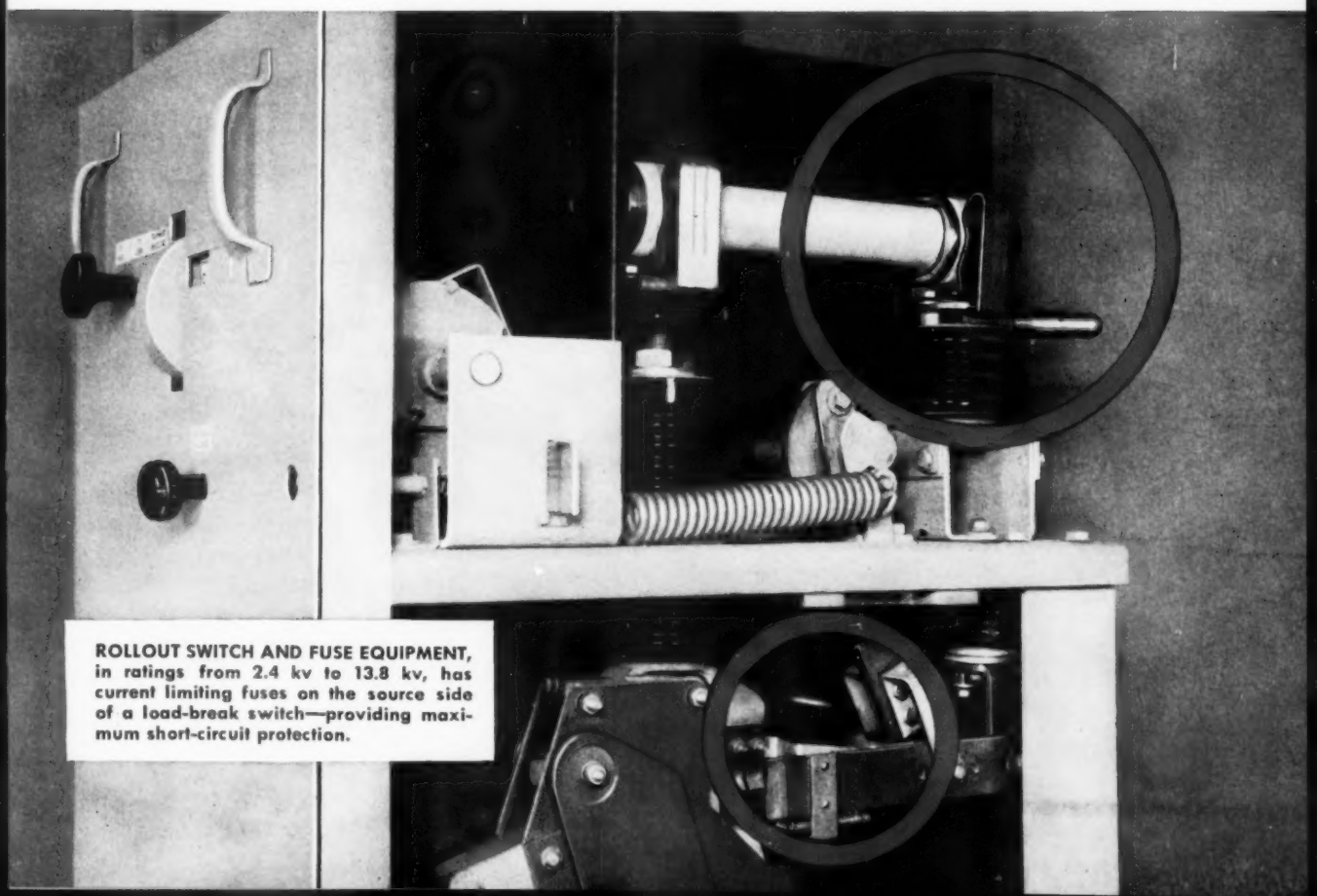
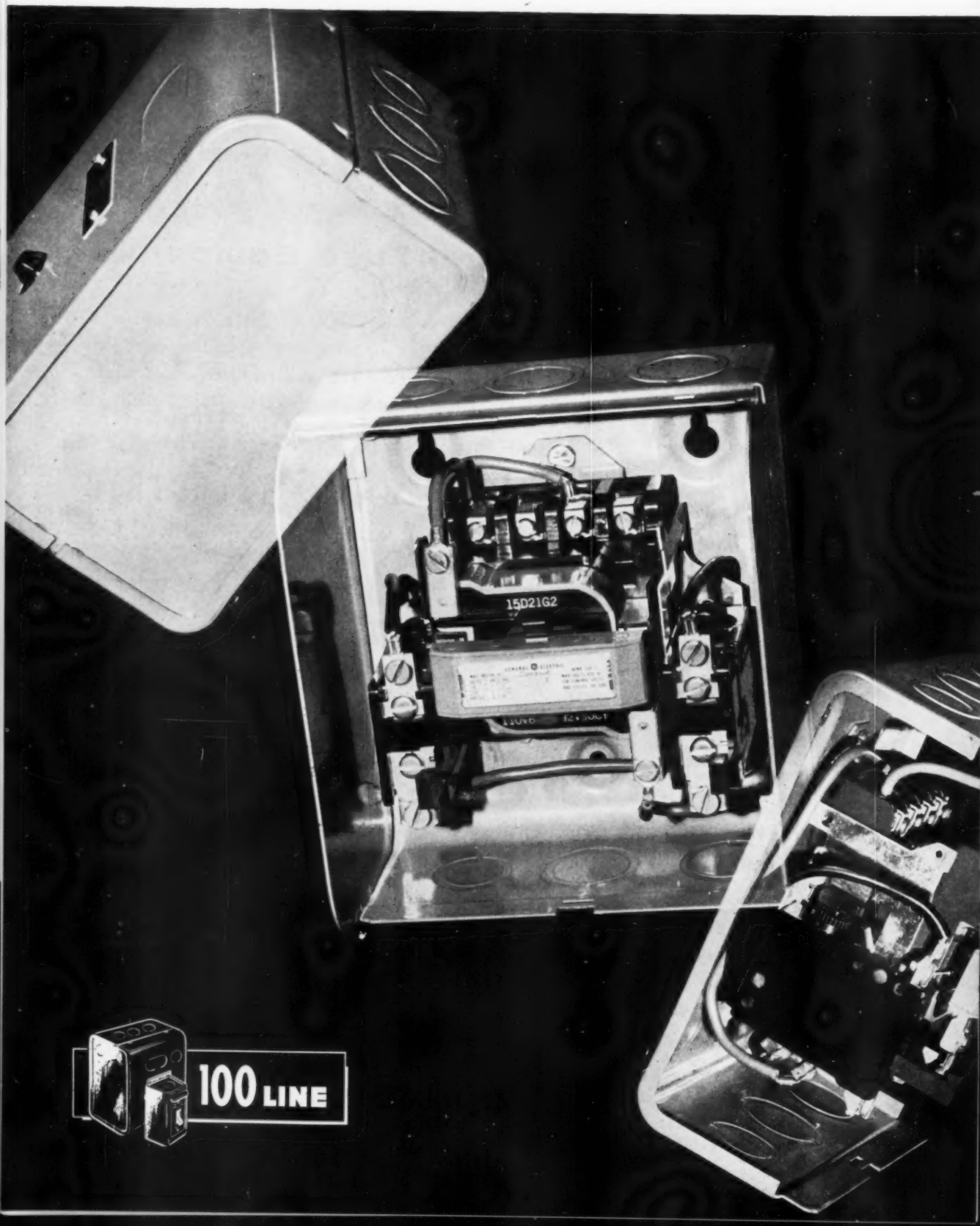


ROLLOUT SWITCH AND FUSE EQUIPMENT, in ratings from 2.4 kv to 13.8 kv, has current limiting fuses on the source side of a load-break switch—providing maximum short-circuit protection.

REMOVABLE SIDES PROVIDE 180° ACCESSIBILITY—



MAKE THE RADICALLY NEW GENERAL ELECTRIC SIZE 0 AND 1 MAGNETIC STARTERS

EASY TO INSTALL

From enclosure to terminals, these new, radically different General Electric magnetic starters have been designed to simplify installation and wiring. Here's how:

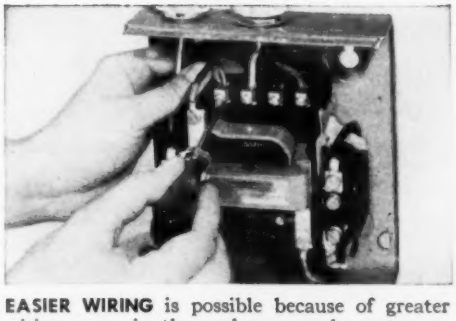
180° ACCESSIBILITY. Both the enclosure cover and sides are easy to remove. Just press the spring-clip latch, and the wrap-around cover is released. Each side is held to the back of the enclosure by two screws. Just a half turn of each screw and the side can be removed. You have 32% more wiring room in the new General Electric enclosure—even with the sides on.

FRONT WIRING. All wiring on the new General Electric starters is done from the front. All line terminals are at the top, and all load terminals are at the bottom. Straight-through wiring and new pressure-type terminals save you time because no wires need be bent or looped.

Like more information? Contact your nearby G-E Apparatus Distributor, or write to Section 733-39, General Electric Company, Schenectady, N. Y. and ask for bulletin GEA-6611.

General Purpose Control Department, Bloomington, Illinois.

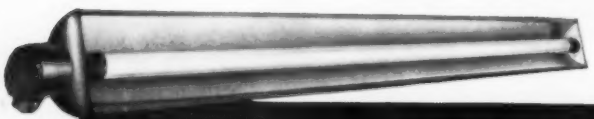
GENERAL ELECTRIC



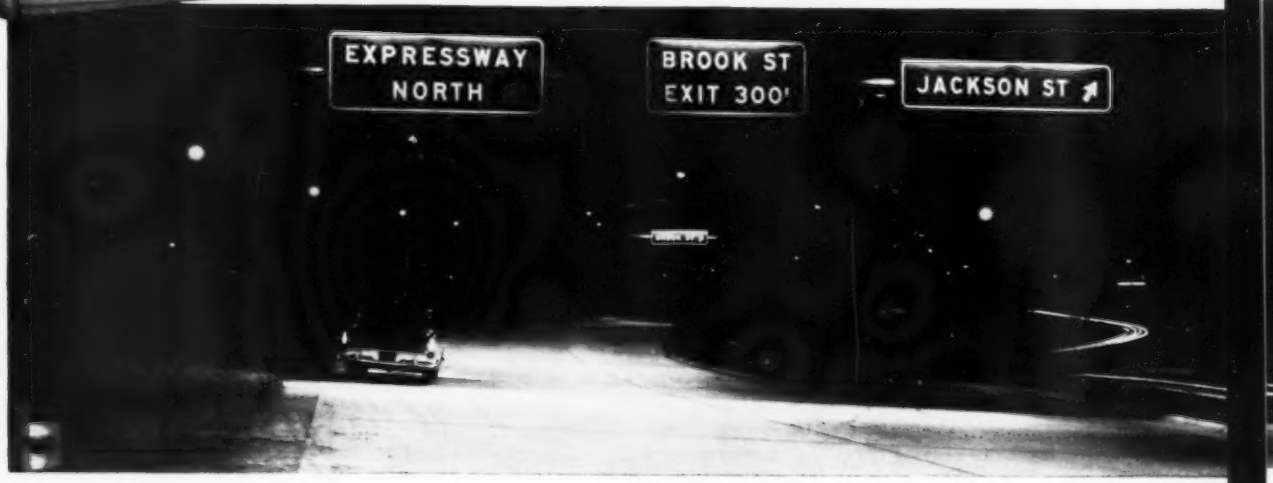
EASIER WIRING is possible because of greater wiring space in the enclosure, and greater accessibility made possible by the removable sides.

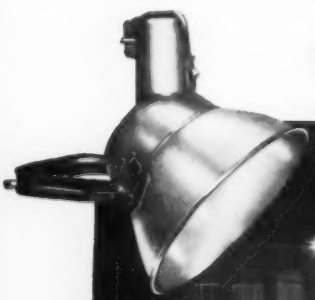
NEW FHP MANUAL STARTER has an exclusive plug-in overload relay heater and fits any standard wall box. Ask for bulletin GEA-6388.

MERCURY Now available, 100- to 1000-watt mercury gives twice the light per watt, 2 to 6 times longer lamp life than filament. Economical for area lighting!

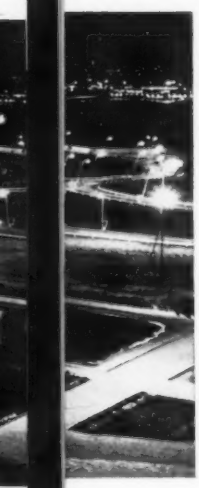


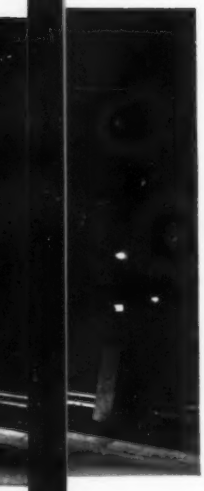
FLUORESCENT Fluoroflood fluorescent fixtures (used here for guide-sign lighting) now in 4-, 6-, or 8-foot lengths—for High Output or Power Groove lamps.





FILAMENT Available from 250 to 1500 watts, General Electric's complete line of filament floodlights includes a model just right for almost any application.





***ONLY* WITH GENERAL ELECTRIC OUTDOOR AREA FIXTURES CAN YOU CHOOSE FROM**

ALL 3 LIGHT SOURCES

. . . AND GET THESE IMPORTANT BENEFITS

LOWEST COST CONSISTENT WITH HIGH QUALITY

Greater efficiency, more uniform light distribution, less maintenance, longer life—all mean savings for the user, now and later! General Electric premium-quality floodlights cost no more than ordinary floodlights! When you select General Electric floodlights, you can be certain you'll get the proper unit to do the job. Heavy-duty, general-purpose, or open units . . . fluorescent, mercury, or filament sources—General Electric has all the tools for your outdoor area lighting needs.

QUICK INSTALLATION, PRACTICALLY NO MAINTENANCE

Sturdily designed General Electric floodlights are quick and simple to mount, aim, connect, and maintain. The L-100, L-55, and L-80 series (filament and mercury) are equipped with threaded studs for 1½-inch conduit mounting; flat mounting bases are also available. The L-69A (filament and mercury) is mounted with galvanized-steel brackets, while the L-100 and L-55 units can be equipped with rugged cast aluminum supports. All parts are made of weather-resistant materials, and all floodlights are equipped with easy-to-read degree scales to facilitate aiming. Life of cable insulation and lamps is increased by cooler-operating General Electric floodlights.

MORE LIGHT PER UNIT, BETTER DISTRIBUTED LIGHT

As much as 35% more light—and more even light distribution—is provided by the exclusive "diamond-back" faceted reflector of General Electric's Type L-69A, L-100, and L-55 filament and mercury units. The optical design of the new Fluoroflood fluorescent fixture directs an optimum, uniform amount of light onto a surface, eliminating "hot spots" and dim areas. Large parking areas, highway guide signs, recreation facilities—whatever the application, modern General Electric outdoor area lighting fixtures do the job best.

AVAILABILITY FROM MANY DISTRIBUTORS' STOCKS

Coast-to-coast, more than 500 electrical distributors are franchised to supply General Electric floodlights from stock or by prompt shipment. Call in your distributor early on any floodlighting job. Besides application assistance, he can supply the complete lighting package—fixtures, lamps, cable, control, transformers, poles, etc.—to meet your needs.

Get all the facts on General Electric's complete line of mercury or filament floodlights, the Fluoroflood fixture, and the latest floodlight application practices. Just send in the coupon below, or contact your nearest General Electric floodlight distributor.

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Section C451-198, General Electric Co., Schenectady 5, N. Y.
Please send me free information on the subjects checked below:

☐ Filament Floodlighting ☐ Mercury Floodlighting

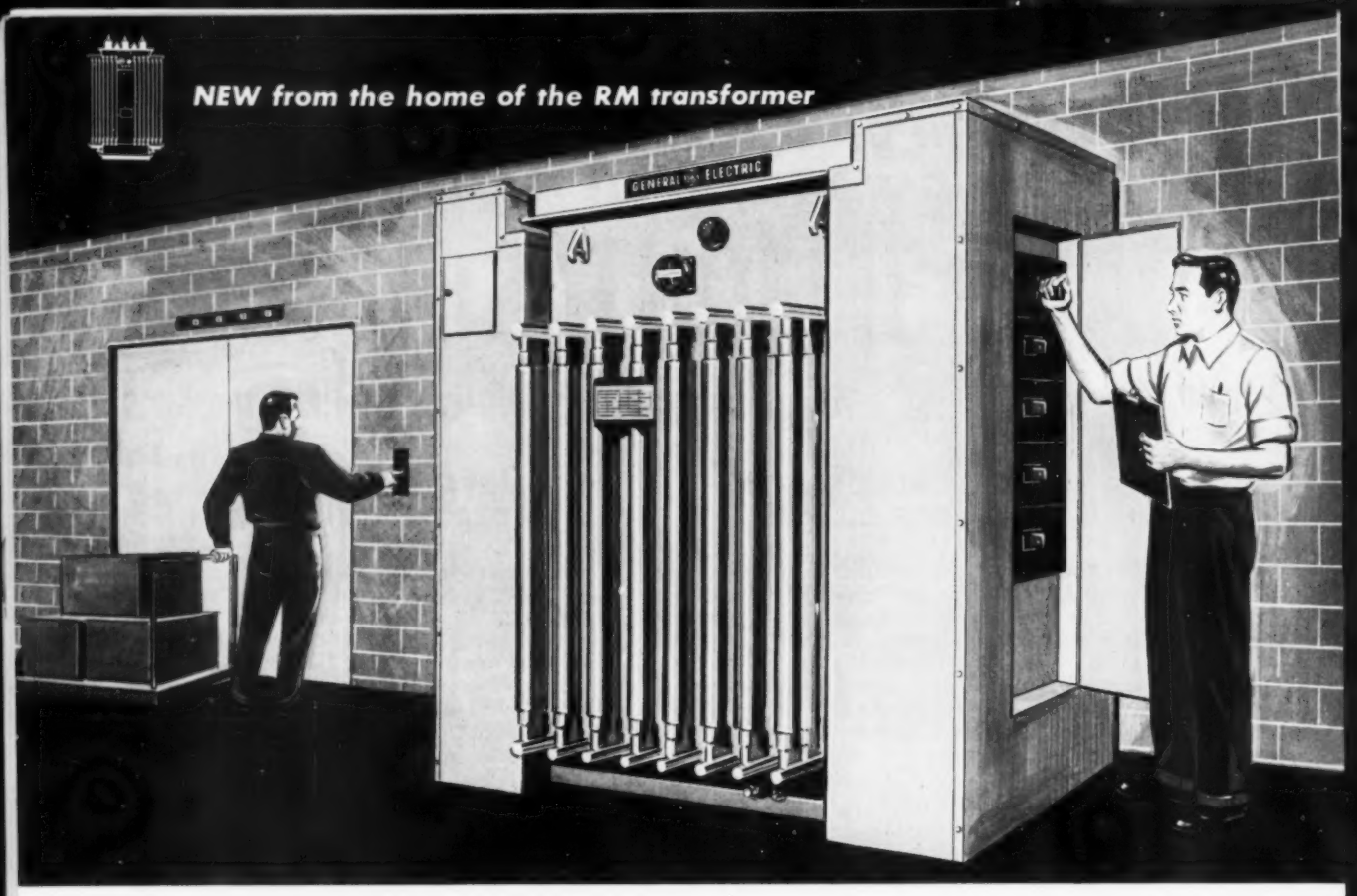
☐ Fluoroflood Fluorescent Fixture ☐ Application manual, "How to Select and Apply Floodlights"

Name_____

Company_____

Street_____

City_____ State_____



G-E INTEGRAL DISTRIBUTION CENTERS . . .

Compact, economical power packages

General Electric Integral Distribution Centers are ideal for supplying light power needs in small plants, office buildings, and similar installations.

ECONOMICAL

Integral Distribution Centers are the most economical type substations available. They co-ordinate components in a single, compact package without requiring assembly of expensive panelboards. G-E Integral Distribution Centers are available with open-dry, sealed-dry, or liquid-filled transformers.

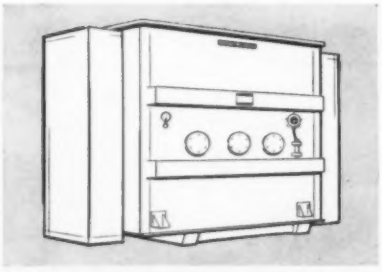
EASY INSTALLATION

These lightweight units require little floor space, allowing easy installation in any convenient location—balconies, basements, indoors or outdoors.

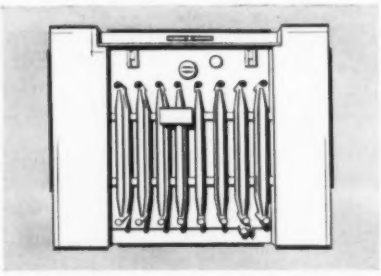
FULL INDUSTRIAL LINE

Regardless of your plant's operating conditions, there is an appropriate transformer in General Electric's complete line. Your G-E sales engineer can show you how you can save with faster shipment, easier installation, reduced maintenance, and longer transformer life. General Electric Co., Schenectady 5, N. Y. 417-3

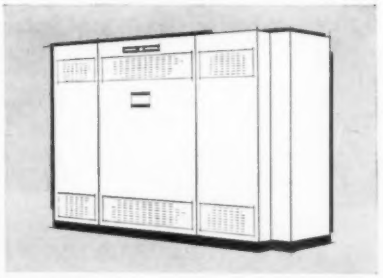
GENERAL ELECTRIC



SEALED DRY-TYPE transformers feature lightweight, long life, broad application.



LIQUID-FILLED transformers feature high impulse strength, broad application.



OPEN DRY-TYPE transformers feature lightweight, small space requirements.

"How G-E carbon brush engineers helped...

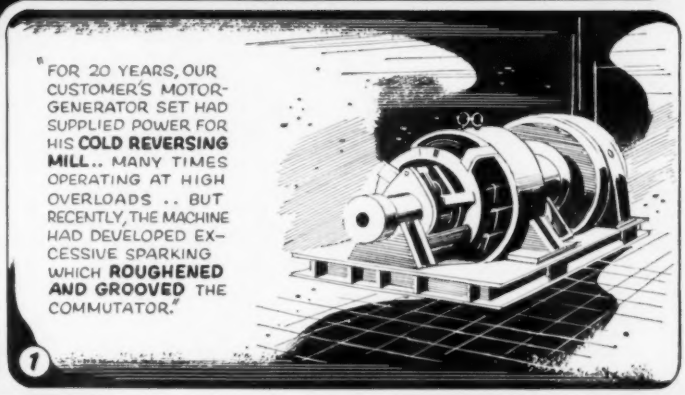
STOP POOR COMMUTATION"

A GENERAL ELECTRIC CARBON BRUSH CASE HISTORY

AS TOLD BY

Carl Ahlstrom

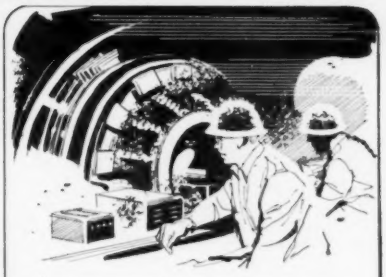
CARBON PRODUCTS APPLICATION ENGINEER GENERAL ELECTRIC COMPANY



1 "FOR 20 YEARS, OUR CUSTOMER'S MOTOR-GENERATOR SET HAD SUPPLIED POWER FOR HIS **COLD REVERSING MILL**.. MANY TIMES OPERATING AT HIGH OVERLOADS .. BUT RECENTLY, THE MACHINE HAD DEVELOPED EXCESSIVE SPARKING WHICH **ROUGHENED AND GROOVED** THE COMMUTATOR."

2 "IN SPITE OF MANY ATTEMPTS BY THE CUSTOMER TO IMPROVE THIS CONDITION, SEVERE **SPARKING** PERSISTED. THE ONLY IMMEDIATE ANSWER WAS **REPEATED GRINDING** OF THE COMMUTATOR.. A **COSTLY** AND **TIME-CONSUMING** JOB."

3 "FACED WITH **CONTINUING MAINTENANCE,** THE CUSTOMER MADE A **DECISION**". A GENERAL ELECTRIC CARBON PRODUCTS APPLICATION ENGINEER WAS CALLED AND A THOROUGH ON-THE-JOB STUDY WAS RECOMENDED TO LOCATE THE PROBLEM.



4 "WE CONNECTED A RECORDING OSCILLOGRAPH AND BRUSH PROBES TO THE M-G SET TO MEASURE VOLTAGE DROP DURING TRANSIENT LOADS. IT WAS QUICKLY APPARENT THAT THE MACHINE **ADJUSTMENT WAS OFF.** BRUSHES WERE SHIFTED TO PROPER ELECTRICAL NEUTRAL, AND THE COMMUTATING FIELD STRENGTH WAS ADJUSTED.. A **G-E** BRUSH WITH **BETTER COMMUTATING** CHARACTERISTICS FOR THIS APPLICATION WAS SUBSTITUTED."

5 "**RESULTS?** NOW OUR CUSTOMER'S COMMUTATION PROBLEM IS CLEARED UP. SINCE THE CHANGE WAS MADE, HE'S ENJOYED GREATER OUTPUT, **LONGER BRUSH LIFE** AND **BETTER SERVICE CONTINUITY.**"

"**FAST FOLLOW-UP** BY **G-E** ENGINEERS, AND A **COMPLETE LINE OF BRUSHES** CAN HELP YOU GET TOP PERFORMANCE FROM **YOUR G-E** MOTORS AND GENERATORS."
FOR ADDITIONAL INFORMATION ON **G-E** CARBON BRUSHES OR COMMUTATION PROBLEMS USE COUPON OR CONTACT YOUR NEARBY APPARATUS SALES OFFICE OR DISTRIBUTOR, GENERAL ELECTRIC CO., SCHENECTADY 5, N. Y.

GENERAL ELECTRIC CO.
Section C774-6 • Schenectady 5, N. Y.

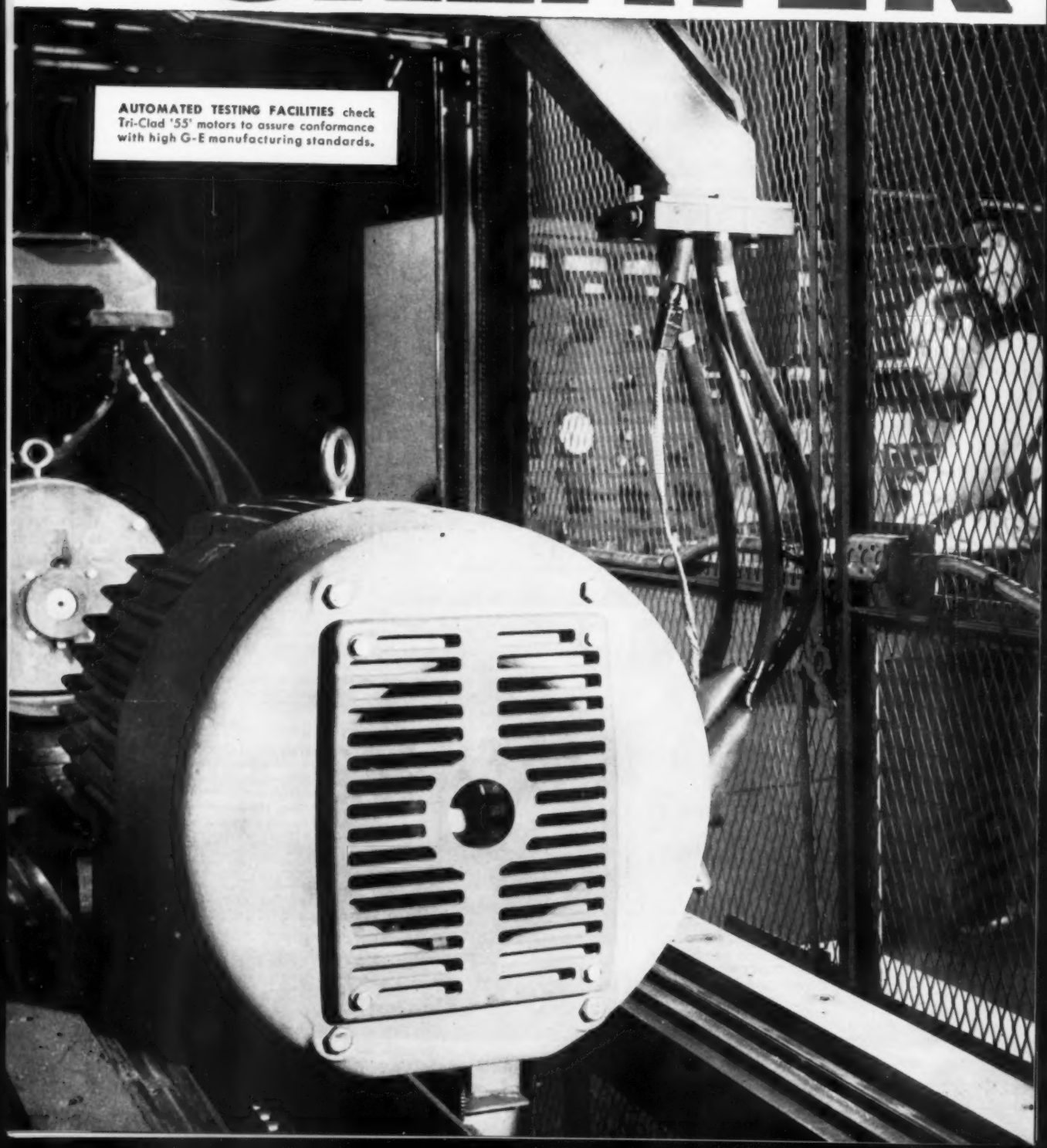
- ☐ Please send GER-949, "How to Adjust Commutation Accurately from Brush-potential Measurements".
- ☐ GEA-6688 "Better Carbon Brush Performance"
- ☐ GEA-5597 "G-E Carbon Brushes for Motors and Generators"

NAME_____
TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ STATE_____

GENERAL ELECTRIC

compact . . . power packed

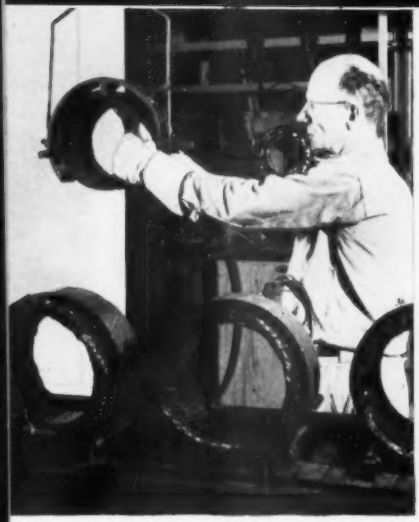
New General Electric
GREATER



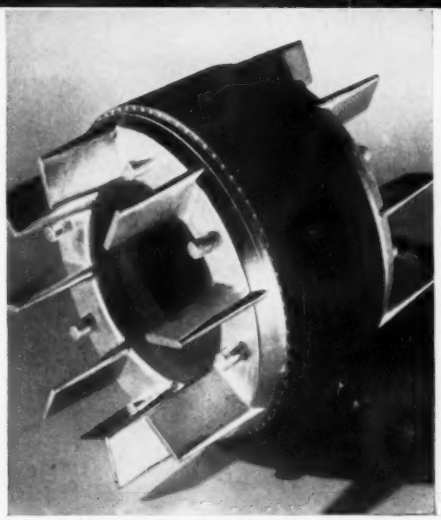
TRI 55 CLAD Motors Offer . . .

RELIABILITY

NOW AVAILABLE THROUGH 125-HP



MORE EFFECTIVE INSULATION—New Mylar* polyester film slot and phase insulation gives Tri-Clad '55' stators up to 8 times more protection than conventional types. Formex® wire gives protection against heat aging.



MORE EFFICIENT ROTORS—Revolutionary new double-entrance centrifugal casting technique is utilized on rotors for new larger ratings—up through 125-hp. Solid castings result, helping to prevent localized heating.

MORE FULLY PROTECTED ENCLOSURES—Tri-Clad '55' motor frames and end-shields are cast-iron constructed to provide rigid support and corrosion resistance. Cast-in louvers help protect against contaminant entrance.

immediate shipment . . . all ratings

To cost-conscious motor users, greater equipment reliability means both immediate and long-run cost reductions. In the immediate future, it minimizes profit-robbing downtime and cuts maintenance costs; and, in the long-run, it reduces replacement costs because motors last longer.

Now, to provide increased reliability for motor users, General Electric offers a complete line of Tri-Clad '55' motors—up through 125-hp—designed to new NEMA space and weight-saving dimensions.

QUALITY CONSTRUCTION GIVES GREATER RELIABILITY—New materials and manufacturing techniques—such as those described above—are used in the production of Tri-Clad '55' motors to give added service life, with fewer breakdowns and reduced maintenance.

But, greater reliability is not the whole Tri-Clad '55' motor story. G-E engineers have also designed these new motors to provide easier installation, and reduced shipping, handling and storage costs. And, you can get *immediate* shipment—usually from warehouse stocks—of any popular Tri-Clad '55' motor rating, up through 125-hp.

FOR COMPLETE INFORMATION on the new line of Tri-Clad '55' motors, contact your nearby G-E Apparatus Sales Office or Distributor. Send in the attached coupon for free Tri-Clad '55' motor bulletins.

*Reg. DuPont Co. Trademark

Section G891-9
GENERAL ELECTRIC COMPANY
Schenectady 5, New York

Please send me the following publications:

☐ **FREE BULLETIN (GEA-6602) describes advanced features of new Tri-Clad '55' motors through 125-hp.**
☐ **FREE SLIDE RULE (GEN-148) to determine weight and space-saving benefits of new Tri-Clad '55' motors.**

NAME .....

TITLE .....

COMPANY .....

ADDRESS .....

CITY & STATE .....

Progress Is Our Most Important Product

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REVERE ULTRA-LITES and "4200" SERIES FLOODLIGHTS *give even, shadowless illumination to this outstanding new super-service station. Ultra-Lites form square shaped light patterns which overlap to eliminate "dark spots". Service area illumination is 25 average foot candles, with a ratio of about 2 to 1 overall. In addition to advanced lighting, Ultra-Lites are themselves styled with an "advanced look" that adds much to the modern layout and architecture of the site.*

Revere Ultra-Lites are right for Chicago's "Auto World"

Revere has the right fixtures for your job too

Bright, even lighting is required by this large new service station to highlight its many services to the passing motorist. Revere Ultra-Lites were chosen because of their even, shadowless illumination.

For your job, too, you can select the exact components you need from Revere — because Revere has the widest line of matched fixtures for outdoor lighting. You can plan your installation with the assurance that all components will "fit" together in assembly. By ordering from one source, you are assured of well planned, complete deliveries to coincide with your job schedule.

Ask your electrical wholesaler to show how Revere fixtures can make your next outdoor lighting installation a more easily planned, more effective job.

Write for Revere's complete Catalog.

Revere ELECTRIC MFG. CO.

Revere Electric Mfg. Co., 7420 Lehigh Ave., Chicago 31, Illinois

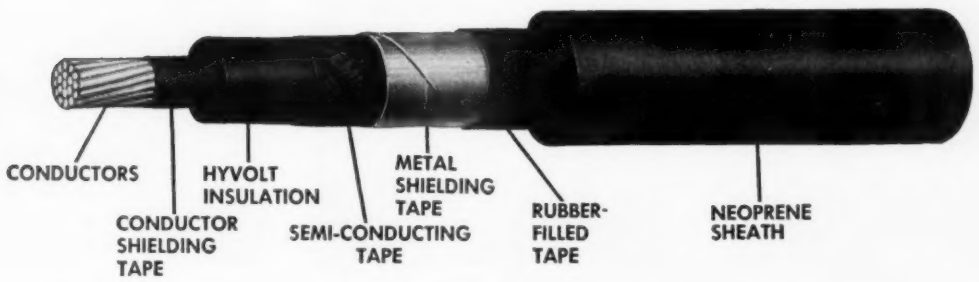
Available in Canada thru Curtis Lighting, Ltd., Leaside, Toronto, Ontario

OUTDOOR LIGHTING: Industrial • Commercial • Service Stations • Streets • Sports • Airports • Shopping Centers

CRESCENT

OVER 70 YEARS EXPERIENCE

HYVOLT SHIELDED POWER CABLE



For More Amperes Per Dollar of Installed Cost

ADVANTAGES

1. Long life
2. Can be operated at 85°C. Permits smaller conductors or more amperes per conductor
3. Freedom from corona cutting
4. Excellent resistance to moisture
5. Low power factor and dielectric loss
6. Lighter, more flexible, easier to handle and install than lead covered cables
7. Electrolytic or chemical corrosion of lead sheath is eliminated by use of neoprene sheath
8. Shielding prevents possibility of surface burning and provides safety to human life.

CRESCENT HYVOLT insulation is made from butyl rubber which is inherently resistant to ozone, heat, moisture and aging. HYVOLT is formulated and processed so as to retain these inherent characteristics of the butyl rubber and at the same time provide excellent electrical and physical properties.

The insulation is protected during and after installation by an outer neoprene sheath providing a maximum degree of toughness, durability and long life. It is flame retarding and resistant to the deteriorating effects of moisture, sunlight, ozone (corona), oil, grease, and many acids and alkalies.

HYVOLT Shielding provides additional internal and external protection in these THREE WAYS

1. Conductor shielding, as provided by a semi-conducting tape over the stranded conductors, excludes air pockets between conductor and insulation and eliminates possible internal corona-cutting of the insulation.
2. The semi-conducting tape between the insulation and metallic shielding tape prevents possible ionization of air spaces and corona at the insulation surface.
3. The metallic shielding tape is grounded when installed, resulting in zero potential to ground at the sheath. It prevents surface discharge or burning, and protects cable from lighting surges. Reduces shock hazard.

RECOMMENDATIONS

CRESCENT SHIELDED HYVOLT CABLE is recommended for use in conduits, underground ducts, in wet or dry locations, or buried directly in the ground, for circuits operated at over 3000 volts and in accordance with I.P.C.E.A. recommendations. Available in single conductor or multi-conductor cables.

Specify CRESCENT SHIELDED HYVOLT POWER CABLE for general power circuits and where severe conditions are prevalent such as chemical plants, refineries, paper mills, mines, sewage disposal plants, etc. It is approved as Airport Lighting Cable Type B, CAA Specification L-824.

SEND FOR BULLETIN

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON 5, N. J.

765 YEARS

W. E. HENGES
President
Started in 1913 as Receiving Clerk

R. B. SAYRE
Vice President
Started in 1921 as Warehouseman

J. REINE
Vice President
Started in 1927 as Warehouseman

ready to serve you!

QUALITY

Experienced men make an experienced organization — one that can be relied on to serve you well.

Graybar, oldest and largest independent distributor of "everything electrical," has long proved the soundness of this principle by continually filling key company posts from within. All Graybar officers and district managers began "in the ranks."

The result? An experienced, close-knit management group who — as clerks, office boys, and salesmen — *themselves* helped build the foundation for Graybar's ever-growing list of customers.

It's easy, then, to see why — with the same opportunities for advancement — each and every Graybar employee has a powerful incentive to do his job well.

Moreover, Graybar is totally owned by its operating and retired personnel. That's another reason why every Graybar employee is personally interested in meeting your electrical needs accurately, helpfully, and as rapidly as possible.

Graybar Electric Company, Inc., Executive Offices: Graybar Building, New York 17, N. Y.

E. R. YONKERS
District Mgr., New York
Started in 1933
as Salesman

E. E. MARTIN
District Mgr., Boston
Started in 1920
in Student Course

J. E. CARROLL
District Mgr., Pittsburgh
Started in 1935
as Salesman

D. A. WILLIAMS
District Mgr., Detroit
Started in 1936
as Warehouseman

100,000 first-quality electrical items are distributed throughout the nation . . .

via GraybaR

GRAYBAR . . . THE LARGEST DISTRIBUTOR

# of electrical experience

D. WALLACE
Vice President
Started in 1922 as Assistant Accountant

A. C. LAMPERTI
Comptroller
Started in 1920 as Bookkeeper

F. E. GIBSON
Treasurer
Started in 1920 as Service & Claims Clerk

W. J. GOERISCH
District Mgr., Philadelphia
Started in 1929 as Manager, Power Apparatus Sales

W. J. BERRY
District Mgr., Richmond
Started in 1937 as Salesman

J. E. FONTAINE
District Mgr., Atlanta
Started in 1928 as Warehouseman

D. L. HARPER
District Mgr., Tampa
Started in 1933 as Salesman

E. P. JONES
District Mgr., Cleveland
Started in 1937 in Student Course

H. G. COOK
District Mgr., Cincinnati
Started in 1920 as Messenger

C. E. KIRKPATRICK
District Mgr., Chicago
Started in 1936 in Office Sales

N. W. ZILCH
District Mgr., Minneapolis
Started in 1934 as Serviceman

M. P. JOHNS
District Mgr., St. Louis
Started in 1939 as Salesman

W. FRAZIER
District Mgr., Kansas City
Started in 1911 as Office Boy

V. A. ELMBLAD
District Mgr., Dallas
Started in 1920 as Warehouseman

V. R. YOUNG
District Mgr., Houston
Started in 1925 in Student Course

G. L. CALL
District Mgr., San Francisco
Started in 1928 as Warehouseman

S. W. SCOTT
District Mgr., Los Angeles
Started in 1928 as Salesman

J. P. LAWTON
District Mgr., Seattle
Started in 1923 as Warehouseman

OF ELECTRICAL SUPPLIES IN THE WORLD

THE GREEN HORNET

Velocity Power's new multiple fastening tool drives studs quickly, accurately, safely

1. 2. 3.

After selecting correct barrel, cartridge, stud and protective shield, open breech with a slight twist of the handle.

Insert pre-assembled stud. Close breech with a half-turn, counter-clockwise.

Position tool on fastening point. Push handle forward. Apply slight pressure. And fire.

A variety of industrial fastening jobs that used to take *hours*, can now be completed in *seconds* with the new Green Hornet.

The load-position-fire operation of this versatile tool makes stud driving as easy as shaking hands. Starting with the hand-contoured grip and trigger-activated firing assembly — and continuing right on down to the permanently attached protective spall-shield, the Green Hornet is designed for easy, economical use.

This new stud driver utilizes the power of blank cartridges in firing pre-assembled studs into steel, masonry or concrete. The sturdy steel studs anchor piping, conduit, electrical boxes, and curtain walls with a minimum expenditure of time and money.

Safety features further increase the user-benefits. A steel piston press-fitted to the end of the stud unit automatically binds the stud if it should waver off its firing course. This binding in the barrel cuts the velocity of the stud, prevents dangerous richocheting. Operator must hold the tool against the work surface with an exerted force of at least five pounds before the firing mechanism can be cocked, so accidental firing by dropping the tool is impossible.

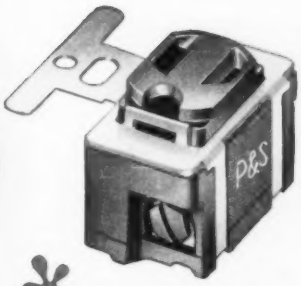
Our new bulletin has the complete story. Write for your copy.

VELOCITY-POWER

TOOL COMPANY

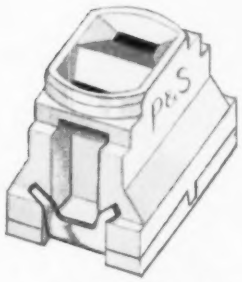
201 North Braddock Avenue
Pittsburgh 8, Pennsylvania

3 NEW DEVICES IN THE P&S DESPARD LINE



(No. 1332 Grounding Outlet)
(No. 1432 Ivory)

(No. 1374 Neon Pilot Light)
(No. 1474 Ivory)



(No. 1425 Single Outlet)
(No. 1325 Brown)

* *Including* A NEW GROUNDING OUTLET

Now the wide range of P&S-Despard wiring devices is extended for even greater versatility with the new grounding outlet No. 1332. Nos. 1325 and 1374 have pressure terminals. Like all P&S-Despard units, they're thoroughly tested for long dependable life. A turn of the cam on the Despard Camstrap quickly locks-in combinations of any two or three Despard units. Custom-make your installations to meet the specific needs of your wiring job—with the original and complete P&S-Despard line.

Send for catalog page on these new devices, Dept. ECM658

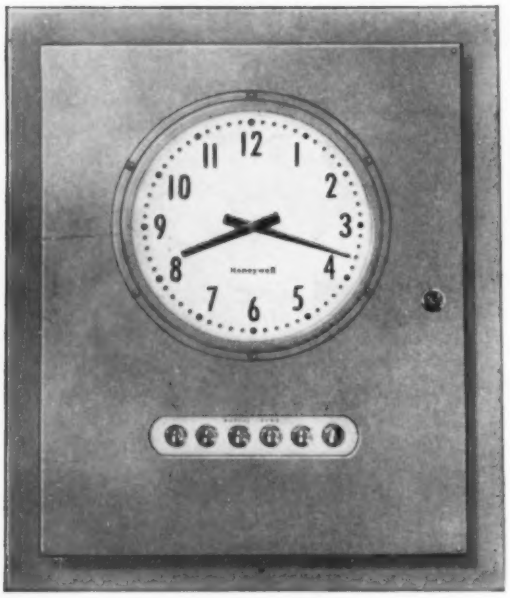
P&S®

PASS & SEYMOUR, INC.
SYRACUSE 9, NEW YORK
60 E. 42nd St., New York 17, N.Y. 1440 N. Pulaski Rd., Chicago 51, Ill.
In Canada; Renfrew Electric Limited, Renfrew, Ontario

MAKE THE COMPLETE JOB *COMPLETELY* P&S

It's Honeywell time for

Announcing the Honeywell



Master time and programmer clocks are flush or surface mounted in either minute impulse or synchronous-wired systems.

Honeywell Clockmaster Systems

Both minute impulse systems and synchronous-wired systems provide:

Handsome clocks in 9″, 12″, 15″ or 18″ dials, flush or surface mounted.

Easy installation with standard plug-and-socket connections . . . no soldering. Mounting hangers and concealed outlets and buzzers for extra neatness.

Simplified link-chain programming. Easy to read, easy to understand, easy to set. Simplest, most trouble-free system available.

Optional spring-reserve power unit. Keeps clocks running during power failure for immediate return to self regulation when power returns.

Signal duration easily varied. Duration switch on surface of master clock provides signal duration from 2 to 25 seconds.

electrical contractors!

Clockmaster Systems*

Honeywell adds its 4th electrical systems product in just 4 months to bring you bigger contracts, better profits.

THIS MONTH Honeywell introduces the Honeywell Clockmaster Systems—newest addition to the fast-growing line of Honeywell electrical systems which offer you more opportunities, guarantee you greater backing.

Now with all four systems shown on these pages you get the special kind of support that only Honeywell gives in your field. Honeywell specialists will assist you with installation problems, help you plan and check systems and make final adjustments. Honeywell services the system during your guarantee period, relieves you of headaches and call backs.

And Honeywell offers your clients a lifetime maintenance agreement providing regular inspection, periodic preventive maintenance by factory trained experts. To get full details on any of the systems shown here, call your local Honeywell office or write Minneapolis-Honeywell, Dept. EC-6-106, Minneapolis 8, Minnesota.

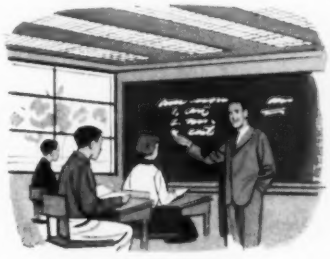
2 Honeywell Fire Detection and Alarm Systems

- Reports fires automatically both within building and to local fire station.
- Transmits alarms even with ground or break in detection circuit.
- Locates fire by numbered light. No listening for number of rings to indicate zone.
- Operates on stand-by battery in case of power failure.
- Easy to install. Detectors fit standard 3" box or plaster ring.

3 Honeywell Hotel/Motel Master*

- Replaces legwork with cheaper, faster electrical signals.
- Puts up to 24 functions under one-man control.
- Custom designed to any hotel or motel specifications.
- Honeywell helps with installation problems, backs your guarantee.
- Honeywell offers owners lifetime maintenance contract.

4 Honeywell Light Saver*



- Phototubes and control panel automatically turn artifical lights on and off as needed to supplement daylight.
- Tests prove savings as high as 80% on lighting bills.
- Helps owner use natural lighting to fullest advantage.
- Honeywell helps with installation problems, backs your guarantee.
- Honeywell offers owners lifetime maintenance contract.

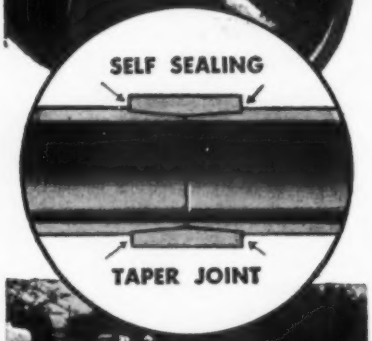
*Trademark

Honeywell

For more to work with... work with Honeywell

H HONEYWELL *First in Control*

SMOOTH BORE!



Orangeburg Fibre Conduit Prolongs Cable Life

Protect cable sheath from abrasion and you prolong the life of underground cables, say utility engineers. Scoring of cable sheath creates "trouble spots" that shorten cable life.

That's where Orangeburg Fibre Conduit plays an important part in keeping cables healthy. Orangeburg's smooth bore, its low coefficient of friction minimize the danger of abrasion when cables are pulled in, as well as later on during cable movement. By protecting cable sheath from abrasion, Orangeburg Fibre Conduit adds years to cable life.

Orangeburg's impermeable wall and watertight joints protect cables from corrosive ground waters. Its nonmetallic material is strong, tough, resilient, long lasting.

And, remember, Orangeburg lays faster and at lower cost than other types of conduit. It is light in weight, easy to handle, easy to tool on the job. Spacers, bends, fittings, 5° bend sections and lightweight tapering tool, all combine to simplify installation.

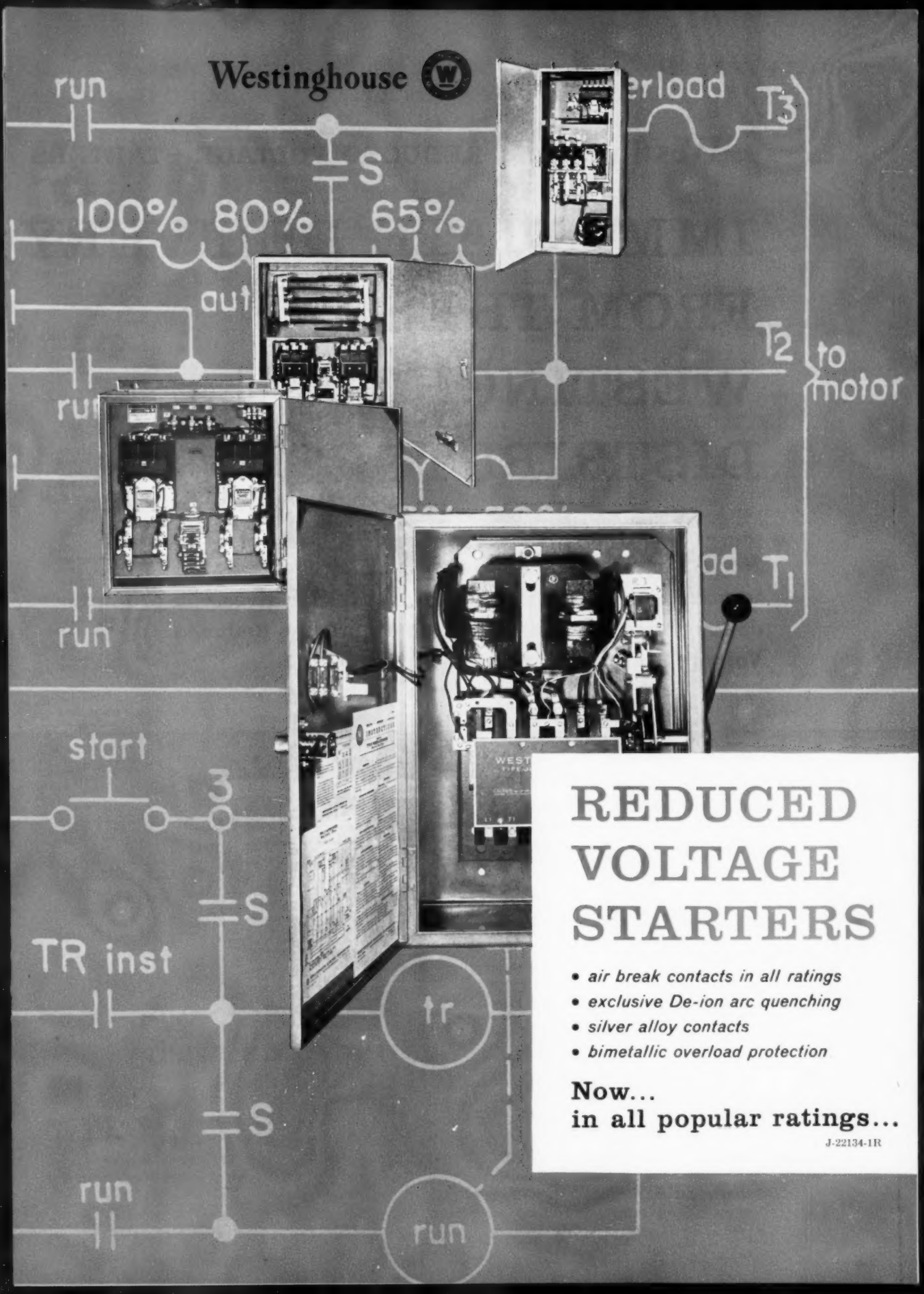
Since 1893, records of long life have proved Orangeburg's durability and economy.

Orangeburg Fibre Conduit is distributed by Graybar Electric Company and General Electric Supply Company with branches and stocks in principal cities.

WRITE DEPT. EC-68 FOR NEW CATALOG 52.

ORANGEBURG MANUFACTURING CO., INC., Orangeburg, N. Y. West Coast Plant, Newark, Calif.

ORANGEBURG®
FIBRE CONDUIT



REDUCED VOLTAGE STARTERS

- *air break contacts in all ratings*
- *exclusive De-ion arc quenching*
- *silver alloy contacts*
- *bimetallic overload protection*

Now...
in all popular ratings...

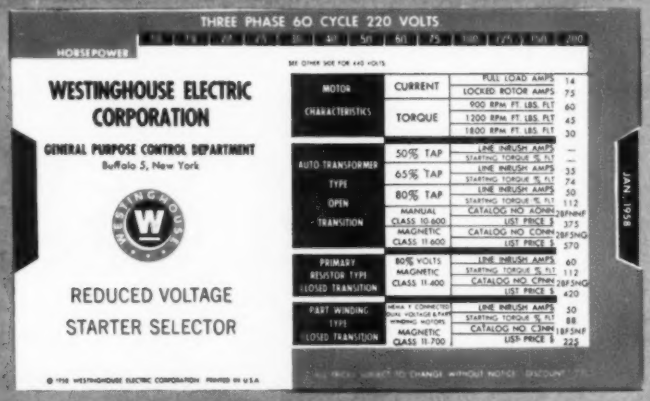
J-22134-1R

Westinghouse REDUCED VOLTAGE STARTERS

IMMEDIATE DELIVERY FROM THESE WESTINGHOUSE DISTRIBUTORS

No waiting . . . no delays. A quick phone call to your nearby Westinghouse distributor gives you prompt delivery and service on the Westinghouse Reduced Voltage Starter you need.

J-22134-2



GET YOUR FREE WESTINGHOUSE STARTER APPLICATION SLIDE RULE

The Westinghouse starter application slide rule is just the "ticket" for easily determining within seconds the exact reduced voltage starter you need for any particular application. Simple to use, with a minimum amount of information required, it will save you considerable time in the accurate selection of all reduced voltage starters.

To obtain your free Westinghouse starter application slide rule, merely phone or write the distributor nearest you whose name and address appear on the following pages. Your free slide rule will be mailed to you immediately.

FROM THESE WESTINGHOUSE DISTRIBUTORS . . . "OFF THE SHELF" SERVICE FOR ALL YOUR REDUCED VOLTAGE STARTER NEEDS

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AL 2-4121

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HE 3-7411

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Tillman & Booth, Inc.
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CO 4-4631

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FA 2-5500

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TU 2-3351

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AL 5-4867

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Westinghouse Electric Supply Co., Inc.
1600 W. Cornell LO 2-8904

J-22134-3

A. L. Myers, Vice President, Manufacturing, discusses the production viewpoint on "conservative design"

"We've found that building mercury lamp transformers 'over spec' actually boosts production"

When one of our constant-wattage mercury lamp transformers leaves the Sola plant, we know for certain that it will do the job for which it was intended. The reason we're so sure of this is that we build every transformer to exceed even Sola's own rigid engineering specifications by an ample margin.

We, in manufacturing, uphold Sola's policy of conservative design by building ballasts "over spec." By using highly-trained people and careful quality control we can hold our rejects down to practically zero . . . and thus actually boost our net output.

This extra effort on our part means you can count on Sola Transformers to deliver maximum performance consistently over a long period of time. The best way to prove my point is to test a Sola ballast yourself. When you do, I'm sure you'll agree with me that the best way to insure excellent performance of your lighting system is to specify Sola.

Write for your copy of Bulletin 17F-MV-306

Sola Electric Co., 4633 W. 16th St., Chicago 50, Ill., Bishop 2-1414 • Offices in principal cities • In Canada, Sola Electric (Canada) Ltd., 24 Canmoter Ave., Toronto 14, Ont.

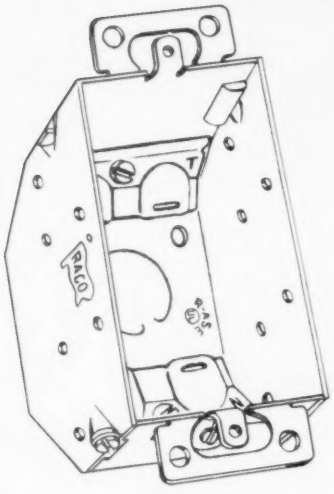
SOLA

CONSTANT VOLTAGE TRANSFORMERS

REGULATED DC POWER SUPPLIES

MERCURY LAMP TRANSFORMERS

FLUORESCENT LAMP BALLASTS



ONLY RACO

SWITCH AND OUTLET BOXES

Have all These Quality

Advantages

- Clean-cut knockouts — easily removed
- Wide-slotted screws with tapered points for easy starting
- Deep, clean-cut threads on screws and tapped holes
- Smooth edges — no burrs or slivers
- Made of heavy gauge steel
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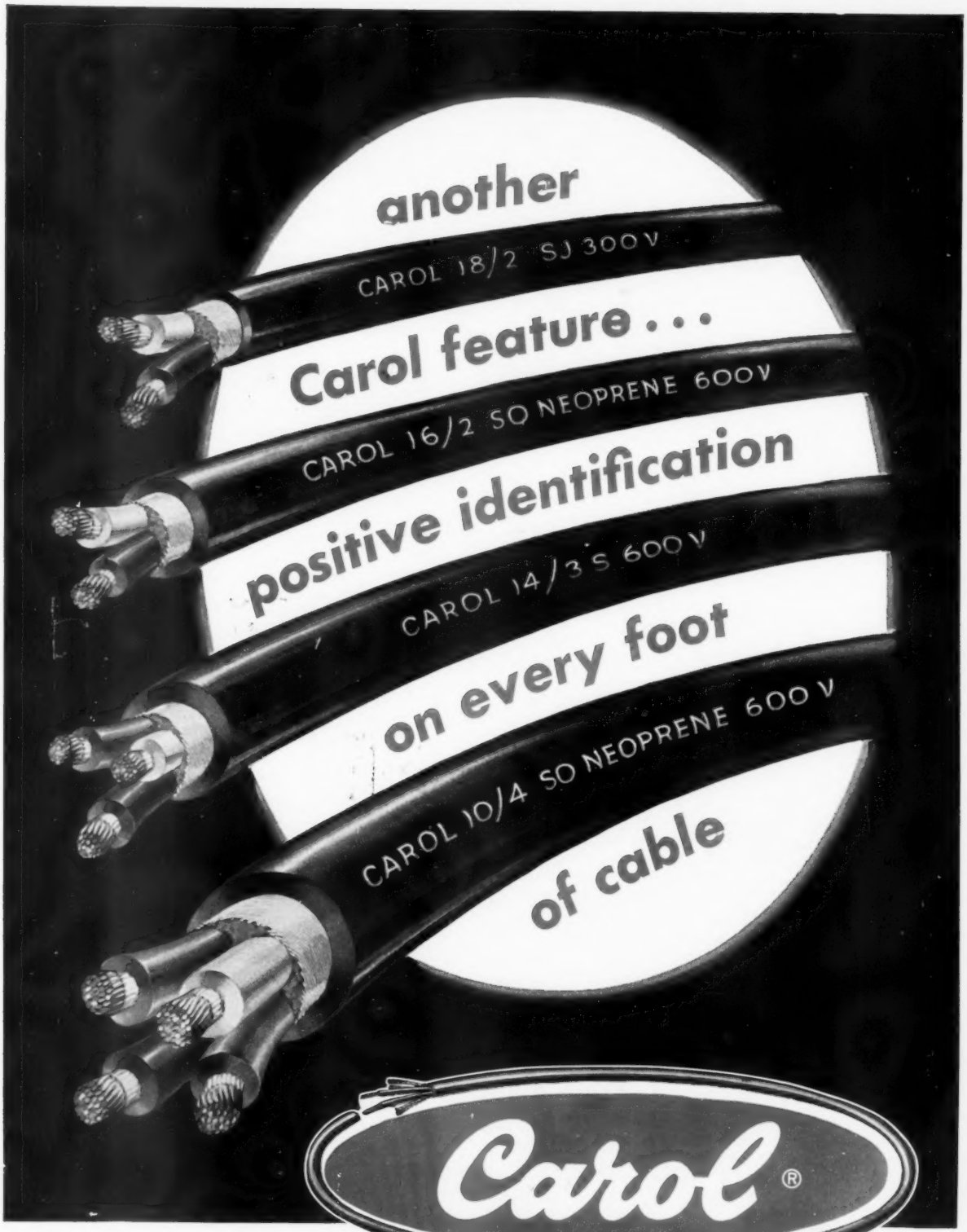

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*Trade-Mark

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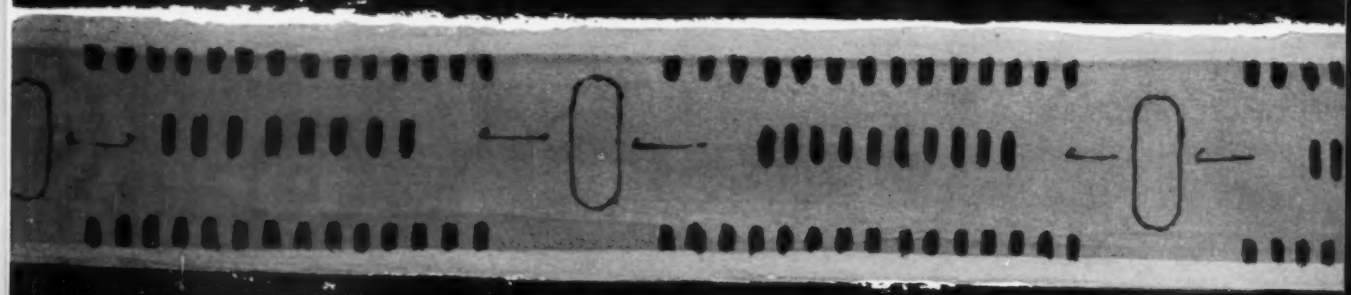
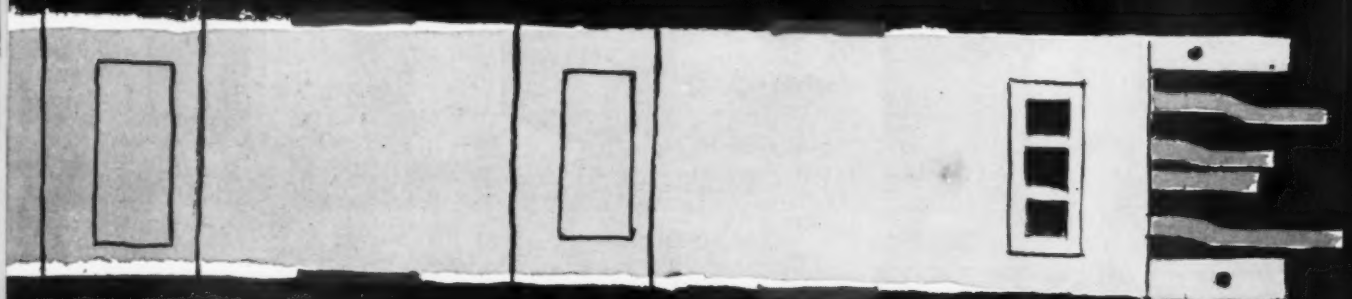
STANDARD CONTROL DIVISION
Beaver, Pennsylvania

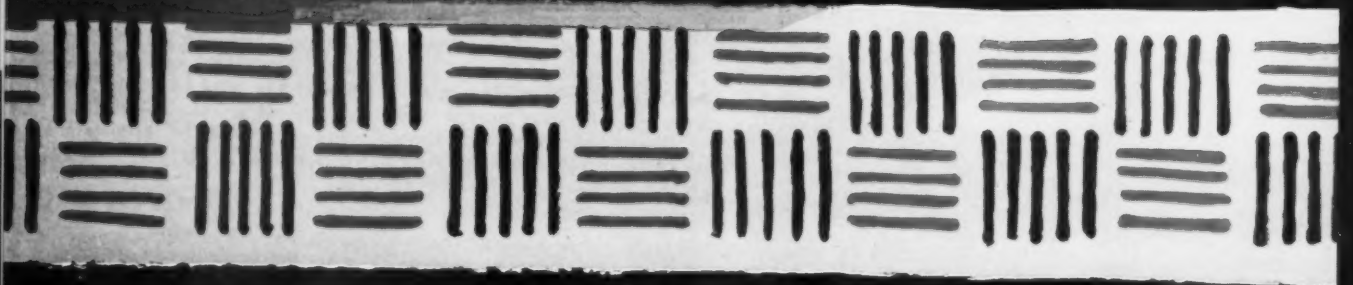


LIFE-LINE BUSWAY

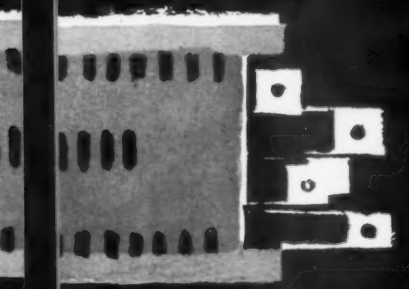


PLUG-IN

CONVENTIONAL WEATHERPROOF



LOW-IMPEDANCE



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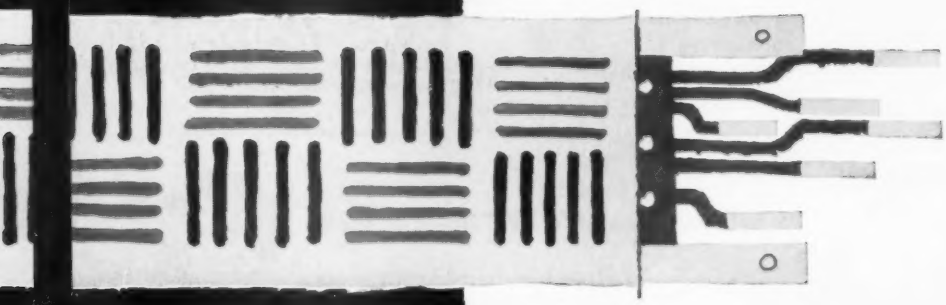
J-30297



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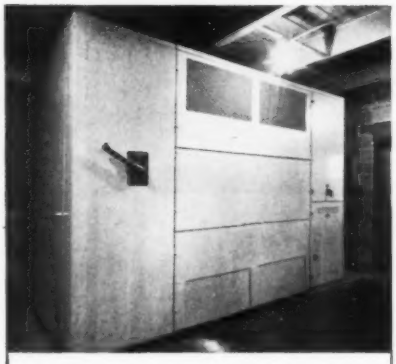
Nation's most modern air terminal served by power from Wagner Transformers!

The "Spirit of St. Louis" is reborn in the city's newest symbol of the air age—the dramatic new terminal at Lambert-St. Louis Municipal Airport. Built at a cost of $7,728,000 and dedicated in 1956, it's the most modern in the nation.

Electric power for this terminal is distributed by five secondary unit substations, rated from 300 to 1500 kva. These were manufactured by Nelson Electric Company and equipped with safe, dependable Wagner dry-type Transformers. Wagner dry-type Transformers are carefully engineered to provide an uninterrupted flow of power—built to stand up under rigorous 24 hours a day schedules. Wagner pioneered in the development of dry-type load center transformers, and the Wagner design is known for its great electrical stamina and mechanical strength.

Wagner dry-type unit substation transformers can answer your power needs just as they do at Lambert-St. Louis Municipal Airport. They are "Predesigned"—coordinated with the specifications of unit substation builders to save you job engineering, time, and cost. Consult the nearest of our 32 branch offices, or write for Bulletins TU-205 and TU-214 for full information.



This is the Nelson main substation at the St. Louis Airport. It is equipped with a 1500 kva Wagner Dry-Type Transformer.

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Electrical Construction and Maintenance

New Service Rules

Amendments to the New York City electrical code affecting high-capacity service installations are expected to be issued in the near future. The new rules are bound to inspire industry-wide discussion and to lead eventually to important changes in service-entrance practice wherever buildings are served from high-capacity underground secondary networks.

The problem has been brewing for several years. New buildings, lighting modernization and heavy air conditioning installations are adding large new loads to secondary supply networks. The networks are heavily reinforced with new transformers. The service stab into the building, consequently, is likely to be backed up by a very high capacity system of very low impedance.

The result is that in the switchboard area and, with some low-impedance feeder systems, for a considerable distance beyond, the short circuit capabilities of the system may far exceed the interrupting capacity of conventional over-current protective devices commonly used in such installations. In fact, engineers have warned that, on full take-offs, short circuit currents may exceed 200,000 RMS asymmetrical amperes.

The new rules are described in detail elsewhere in this issue; however, the main provisions can be briefly summarized as follows:

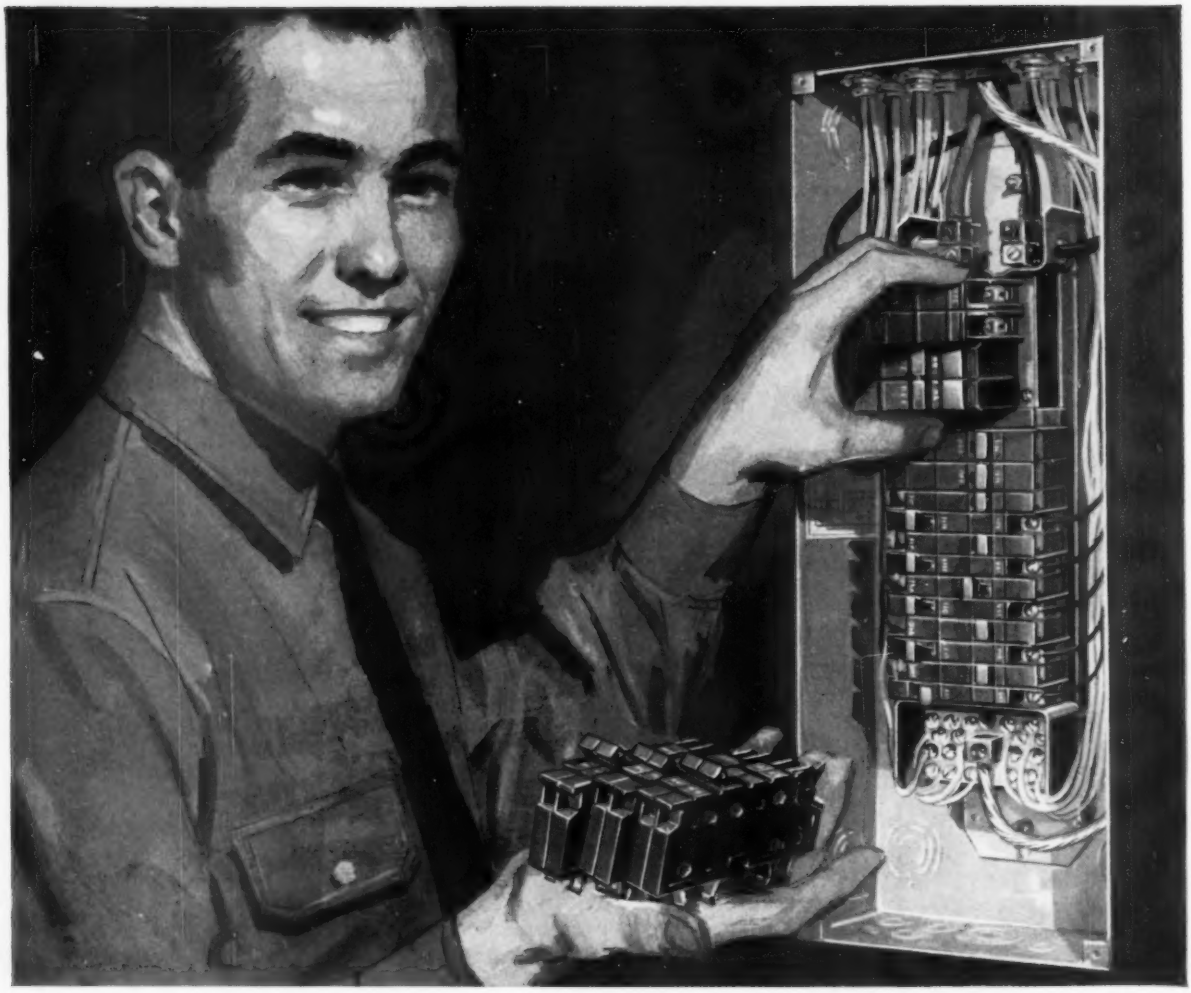
- Service disconnecting means to be provided *at the stab*, rated to be safely operated repeatedly at 150% of load and *remotely operable* from a public area outside the switchboard room.

- Service interrupting fuses, to be provided at the service entrance, of the current-limiting silver-sand or equivalent type capable of interrupting the maximum short circuit current available.

- Low impedance grounding paths to insure fast overcurrent-protective-device operation on phase-to-ground faults.

The provisions set forth are practical measures to deal now with the potential hazards of modern high-capacity services. They are not necessarily the final word. But they will serve as a basis for much-needed reappraisal of current practice and the development of alternative or even better methods.

Wm. T. Stuart



New Space-Saving 1" Double Pole Breaker Adds Flexibility to Cutler-Hammer Unit Breaker Load Centers

Here's important news for you and your customers. New space-saving Cutler-Hammer double pole breakers provide a low cost means for expanding household circuit facilities without installing additional branch circuit units. These new breakers require ⅓ less bus space which means wherever, within their ratings, two double pole breakers are presently installed you can now provide your customer with three double pole circuits. Also, if a homeowner wants an additional lighting circuit, you can replace a present double pole breaker with one of the new space-saving double pole breakers and a single pole breaker. You only pay for the new breakers . . . no new cases or costly installation effort needed.

The new Cutler-Hammer double pole breakers are available in 15, 20, and 30 ampere ratings; and can be installed in any Cutler-Hammer Unit Breaker Load Center without special adapters or case modifications. See your nearby Authorized Cutler-Hammer Distributor and learn how you can serve your customers to a better electrical future with dependable Cutler-Hammer Service Entrance Equipment. CUTLER-HAMMER Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.

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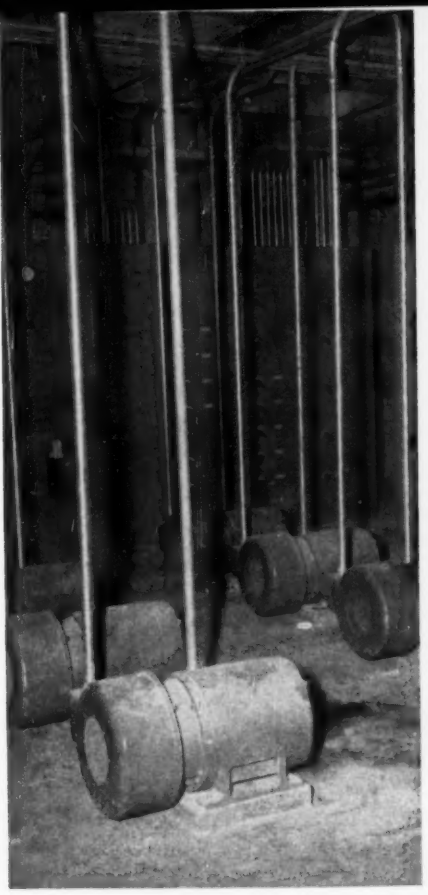


In Houston, bank building uses . . .

200 KW at 600 Volts-840 Cycles

Design and construction details of the automatically controlled, 840-cycle, 600-volt lighting system throughout a five-level, windowless, air-conditioned building for the Federal Reserve Bank. Designed by Dana Price of Golemon & Rolfe, Architects and Engineers, Houston, the complete installation was made by Fisk Electric Company.

By J. H. Blasdell, Superintendent
Fisk Electric Company, Houston, Texas

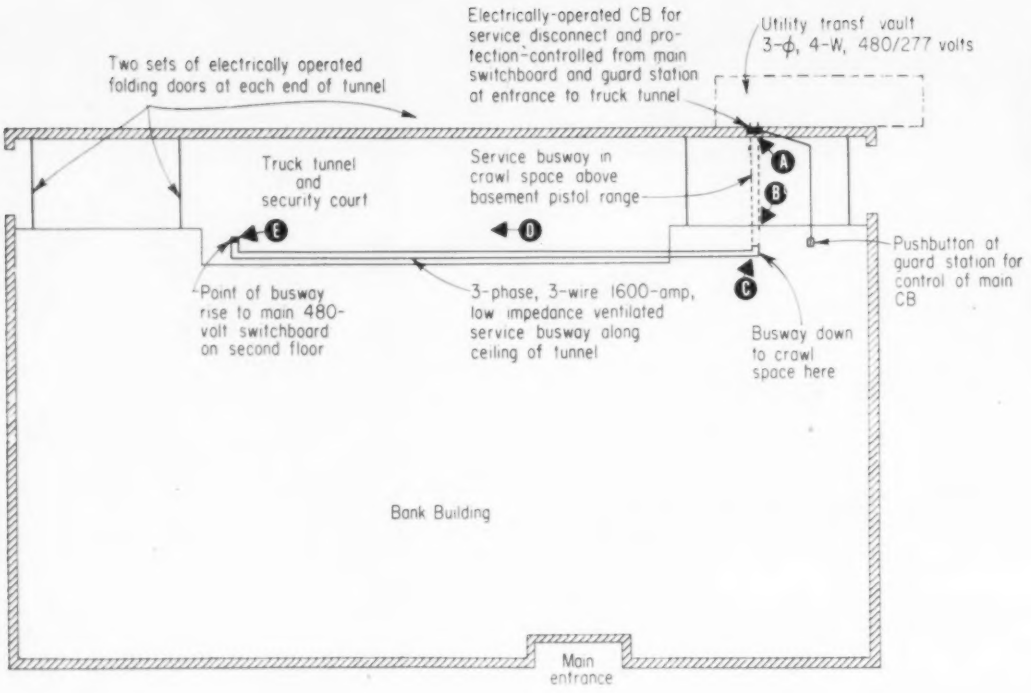
AN IMPORTANT breakthrough for high frequency lighting is represented in the new Federal Reserve Bank Building in Houston, Texas. Here, 200 kilowatts of installed generating capacity supply a complete 600-volt, 840-cycle system of distribution feeders and branch circuits for fluorescent lighting. A number of significant engineering results were achieved with this system:

1. The increased efficiency of standard fluorescent lamps operating at 840 cycles affords modern, high intensity lighting throughout the windowless building with load densities of just under two watts per square foot.

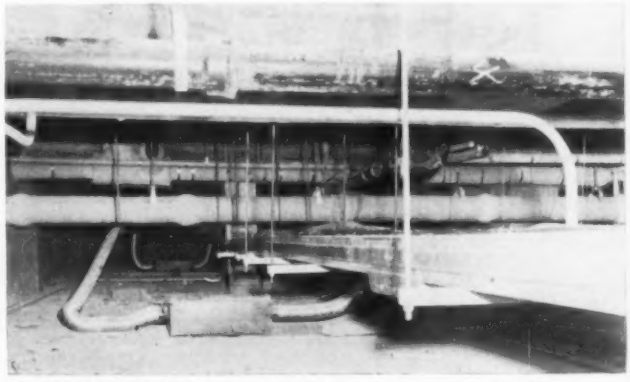
2. The use of 600-volt circuiting provides energy transfer through the system with minimum current, thereby providing maximum efficiency in the use of wire, conduit, protective devices, switchboards, panelboards and wiring devices. And this increased efficiency in equipment application—i.e., pounds of equipment per kilowatt of capacity—provides reduced space requirements for equipment.

3. The elimination of conventional ballasts with their high heat output reduced the required heat removal capacity of air conditioning equipment by about 20% over that which would have been required with 60-cycle lighting. This is particularly significant here because of the hot climate, and because the building has no windows.

4. The overall lighting system for this type of commercial occupancy was particularly well suited to large-area block control by magnetic contactors on the branch circuits. And automatic, programmed control of contactor operation was readily provided with great advantage by an IBM carrier-frequency central control system. This


Electrically-operated CB for service disconnect and protection controlled from main switchboard and guard station at entrance to truck tunnel
Utility transf vault 3-ϕ, 4-W, 480/277 volts
Two sets of electrically operated folding doors at each end of tunnel
Truck tunnel and security court
Service busway in crawl space above basement pistol range
A
B
C
D
E
Pushbutton at guard station for control of main CB
Point of busway rise to main 480-volt switchboard on second floor
3-phase, 3-wire 1600-amp, low impedance ventilated service busway along ceiling of tunnel
Busway down to crawl space here
Bank Building
Main entrance

BASIC PLAN of building is a rectangle. The complete building is a rectangular block—a basement and three floors—with a penthouse structure on top. First floor plan includes a truck tunnel through the rear of the building. Service to the building comes into crawl space above pistol range in basement and is carried up to the main switchboard on the second floor. Circled letters correspond to accompanying photos, with arrowheads indicating angles at which photos were taken.



B—UNDER TUNNEL run of 1600-amp busway is made in crawl space above pistol range, from utility vault to point in background at which busway rises to first floor ceiling.

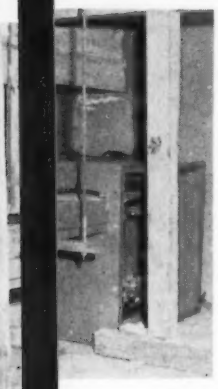
Advantages of High Frequency Lighting

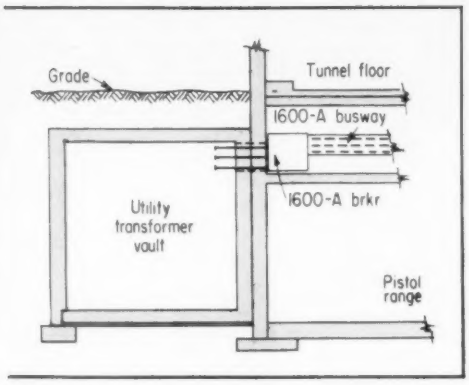
1. For constant lamp watts into a 96T12 lamp operating at 600 volts, lumens of output per watt input increases with frequency from 60 cycles up to about 7000 cycles. Lamp produces about 65 lumens per watt at 60 cycles and about 67 lumens per watt at 840 cycles.

2. The 96T12 which normally operates at 74 watts on 60-cycle input can operate with the same life expectancy at higher wattages on higher frequencies of current alternation. The increase in light output for such operation may be so high as 50% of the 60-cycle value. Higher wattage is obtained by increasing lamp current.

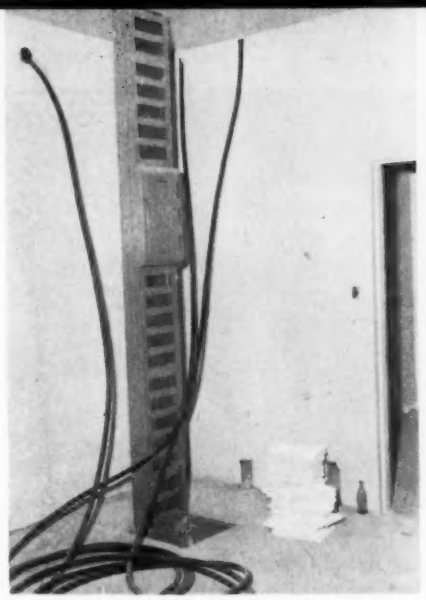
3. Operation of lamp circuits at higher frequencies permits use of small capacitor ballast in place of usual coil type ballast. With the 0% power factor of the capacitor, ballast wattage loss is eliminated. This provides a substantially higher conversion efficiency in the lamp circuit. To deliver 74 watts to a 96T12 lamp requires an input of 91 watts to the circuit operating at 60 cycles with a conventional coil ballast. Only 74 watts input to the circuit is required when a 0% pf ballast is used. And ballast weight is reduced by better than 90%; cost is reduced; hum is eliminated.

4. Combination of 1, 2 and 3 above provides substantially increased light output from fluorescent lamps operating on high frequency circuits. Taking into consideration only 1 and 3 above, light output at high frequency is increased a small amount (65 to 67 lumens per watt) with about a 20% lower power input to the circuit due to elimination of ballast loss. Then adding 2 above, a given number of lamps operating at high frequency can be made to produce about 40% more light output with 40% more power input (compared with maximum operating conditions at 60 cycles and for the same lamp life). Of course, the efficiency of hi-cycle conversion and loss in shunt reactors for power factor correction reduce overall efficiency and must be considered in comparing conventional 60-cycle lighting with high frequency lighting. Overall, however, the net effect is a substantial increase in light output.



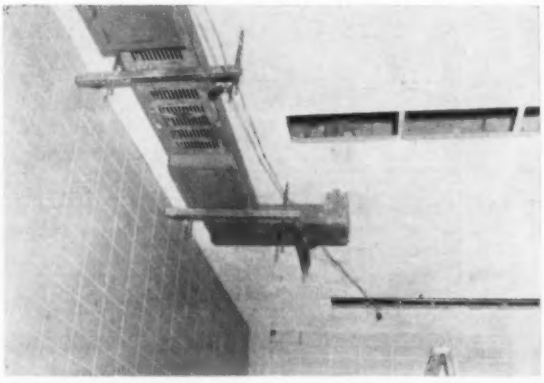


A—1600-AMP CB providing main service disconnect and overcurrent protection for building is mounted against wall through which utility supply is made. Location assures complete protection on 1600-amp service busway within building. CB has sufficient interrupting capability to meet short circuit duty at point of installation. Disconnect of building system from utility supply is effectively provided by electric operation of this CB. Diagram at right details arrangement at main CB.



C—VERTICAL RISE of service busway from crawl space above pistol range to ceiling of first floor comes through first floor room and turns to a horizontal run just above the ceiling here.

D—HORIZONTAL RUN of service busway is carried along ceiling of security court from room in C to point at which busway turns up to supply main 480-volt switchgear at approximate load center of building on second floor.



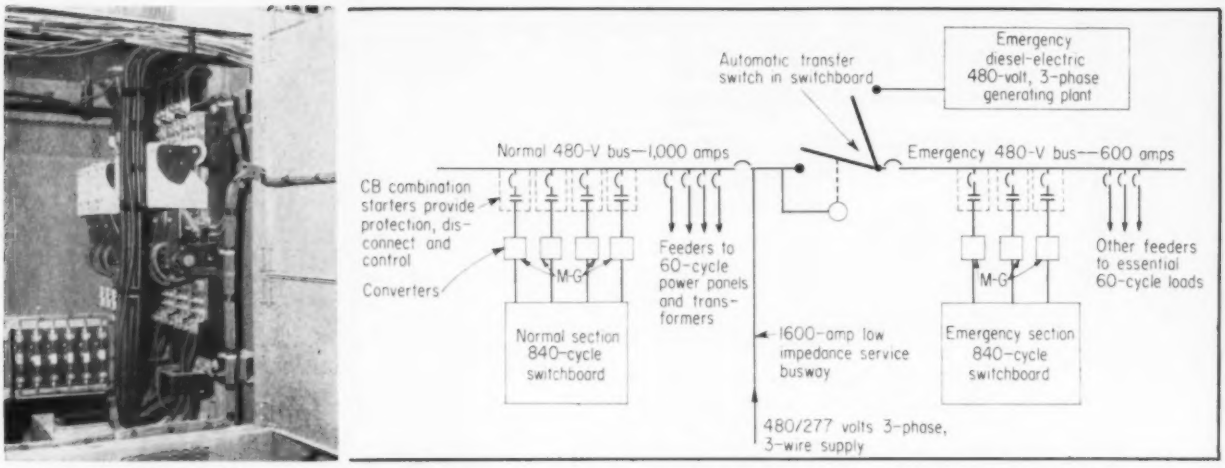
E—CHANNEL IRON busway hangers are supported by rods from inserts in slab above suspended ceiling as shown in the closeup at point at end of security court where service busway turns up through second floor slab into bottom of main switchboard in second floor electric room.

carrier control was also used to program operation of heating, cooling and power loads.

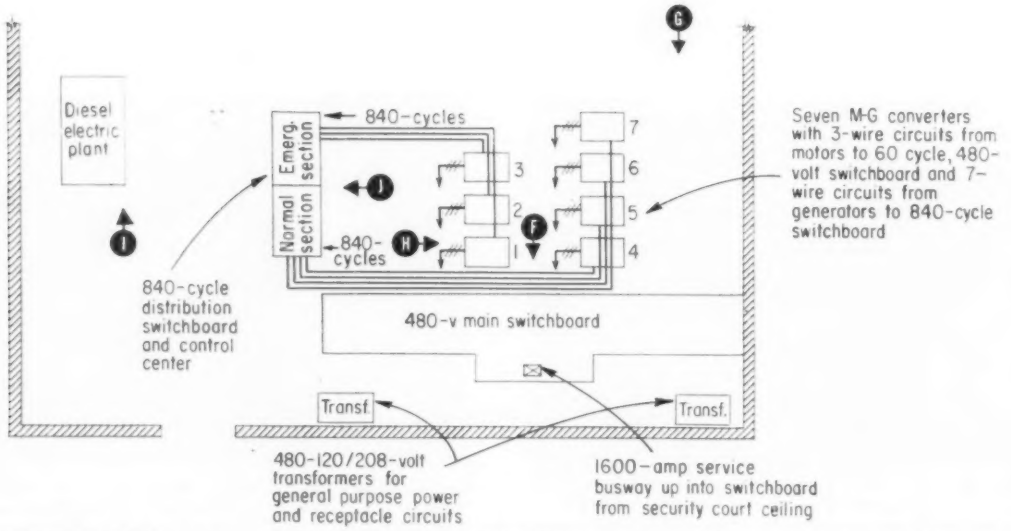
From the design standpoint, this installation is the first large capacity application of high frequency lighting in a commercial building. Previous installations were much smaller and simpler and did not involve the control complexity of this job. For this project, considerable engineering study went into selection of high frequency lighting over conventional 60-cycle lighting. But as soon as cost comparisons dictated use of hi-cycle energy, detailed design work began.

Although previous hi-cycle installations provided much practical design data, there were many specific design problems which had to be investigated and solved on the basis of the size and layout of this job. Nothing was taken for granted. Studies covered: effect of inductance on voltage drop in 840-cycle circuits, increased ac resistance of conductors due to exaggerated skin effect at 840 cycles, effect of higher frequency on the calibration of protective devices, general heating effects, power factor considerations, derating of equipment for hi-cycle use, application and control of frequency conversion equipment, provision of normal and emergency supplies, circuit control, individual switching of luminaires, integrating of 480-volt and 120-volt 60-cycle circuits for power and receptacle circuits. All of these matters were systematically reduced to definitive plans and specifications.

The overall, automatically controlled system is a credit to the design engineer, Dana Price of Golemon and Rolfe, and to M. F. Norris, general foreman for Fisk Electric Company on this job. The highly efficient system provides marked economy in both first cost and in operation. And effective, reliable operation of the equipment makes this installation practical.


Automatic transfer switch in switchboard
Emergency diesel-electric 480-volt, 3-phase generating plant
Normal 480-V bus—1,000 amps
Emergency 480-V bus—600 amps
CB combination starters provide protection, disconnect and control
Converters
M-G
M-G
Feeders to 60-cycle power panels and transformers
Other feeders to essential 60-cycle loads
Normal section 840-cycle switchboard
1600-amp low impedance service busway
Emergency section 840-cycle switchboard
480/277 volts 3-phase, 3-wire supply

F—MAIN SWITCHBOARD consists of normal section and emergency section. All essential loads—both 60-cycle and 840-cycle—are supplied from the emergency bus which, under normal conditions, is connected to the main 1600-amp main supply through an automatic transfer switch. Upon failure of the normal supply, the diesel electric generator is started automatically and the transfer switch connects the generator supply to the emergency bus. Photo at left shows automatic transfer switch in the top of the center section of the main switchboard.

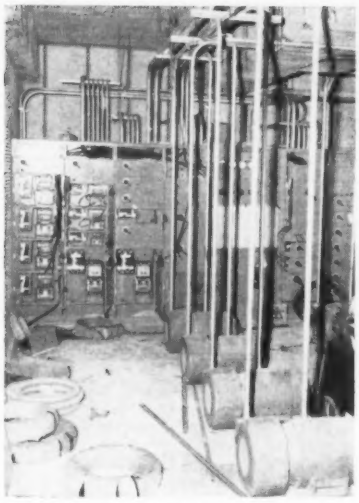

Diesel electric plant
840-cycles
Emerg. section
Normal section
840-cycles
Seven M-G converters with 3-wire circuits from motors to 60 cycle, 480-volt switchboard and 7-wire circuits from generators to 840-cycle switchboard
840-cycle distribution switchboard and control center
480-v main switchboard
Transf.
Transf.
480-120/208-volt transformers for general purpose power and receptacle circuits
1600-amp service busway up into switchboard from security court ceiling

ELECTRIC ROOM on second floor contains major distribution equipment for both 60-cycle system and 840-cycle system. Equipment is laid out as shown in this plan. Circled letters correspond to accompanying photos, with arrowheads indicating angles at which photos were taken.

Power is supplied to the building at 480 wye/277 volts, 3-phase, 4-wire, 60 cycles, from a utility transformer vault adjoining the basement wall near one corner of the building. A 1600-amp busway from the vault is brought through the basement wall into a 1600-amp CB installed in a crawl space above the pistol range and mounted against the inside of the wall. This CB provides main service disconnect and overcurrent protection and is electrically operated from the main switchboard and from a pushbutton station in the guard's office at the entrance to the truck tunnel on the first level. This arrangement of service protection permits carrying the service busway to a main switchboard located at the approximate load center of the building. It provides full protection for the busway run and affords fast, effective interruption of service to the building whenever desired.

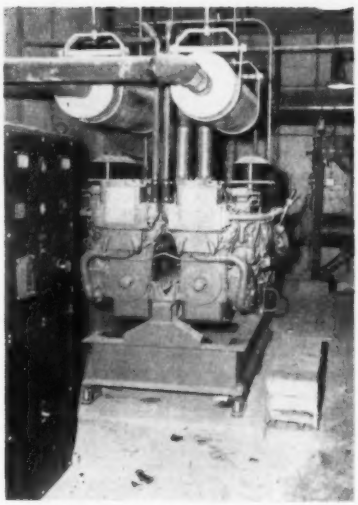
From the main CB in the crawl space, a 1600-amp ventilated service busway is run through the building—horizontally and vertically—to the main switchboard on the second floor of the building. This switchboard is installed in a large sound-proofed room which also houses the motor-generator units for high frequency conversion, the high-frequency distribution switchboards, control equipment for automatic matching of generator output to load requirements, the signal generator and associated equipment for carrier frequency programmed control of light and power loads, step-down transformers for 120/208-volt energy and an emergency diesel electric plant.

The main switchboard is a 480/

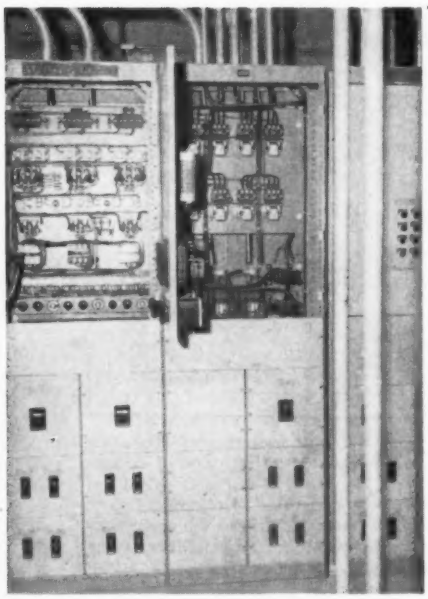


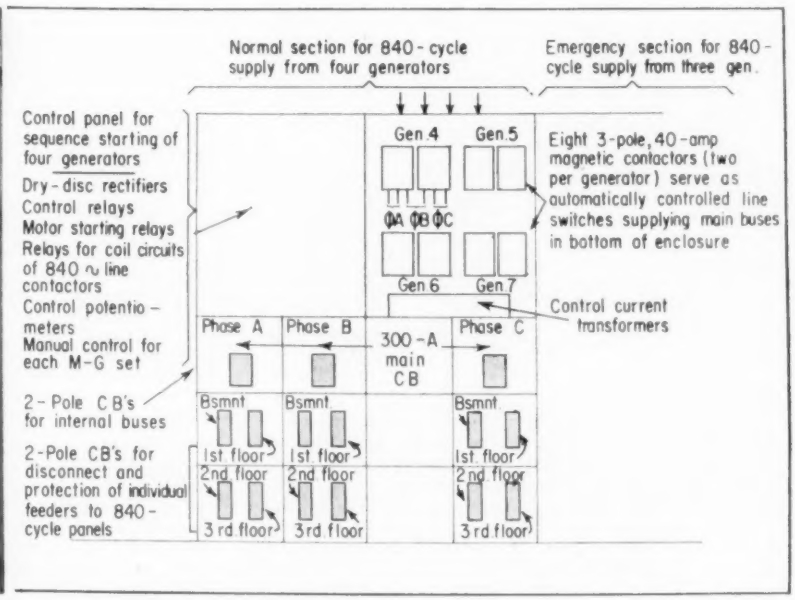
G—FOUR STARTERS, circuit breaker combination type for control of motor ends of four normal 840-cycle generators, are mounted one above another (at extreme left) in normal section of main 480-volt switchboard. Operating coils in motor starters are controlled from control section of normal 840-cycle distribution board as part of automatic operation of M-G sets in response to load requirements.

H—M-G SET consists of a 480-volt, 3-phase, 40-hp motor (near end) supplied by conduit from main switchboard and a 30-kw generator (far end) with three independent 600-volt phases making up a 7-wire (2 wires per phase plus a grounding conductor common to a center tap on each phase winding) output circuit which is carried in conduit to the hi-cycle distribution board. The converters have no slip rings, brushes on exciters, which minimizes maintenance. A direct short on the high frequency side of the converter will not damage the unit.

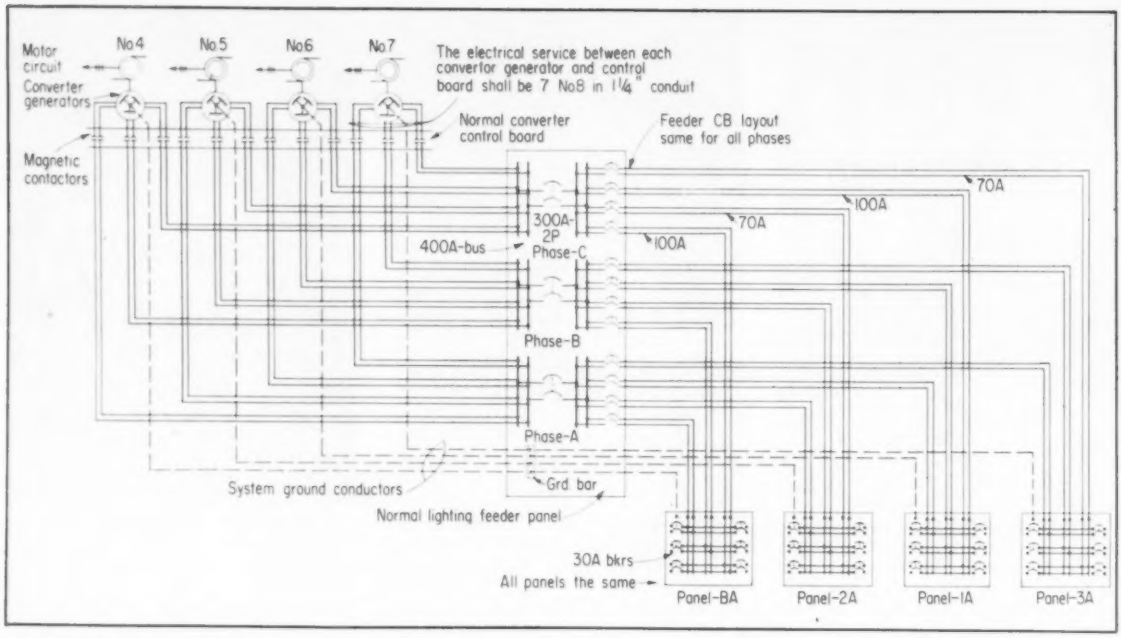


I—EMERGENCY GENERATOR is driven by a 2-cycle, twin 6-cylinder diesel engine fully equipped with a closed type cooling system, and a 12-volt starting motor. Generator has 200-kw output at 80% P.F. and 480 volts, 3-phase.

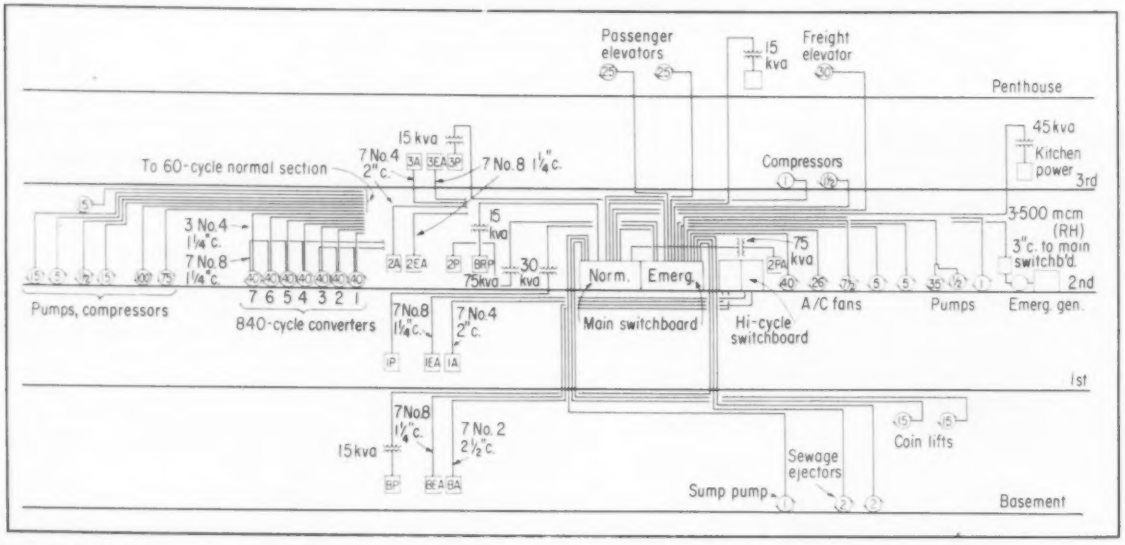



Normal section for 840-cycle supply from four generators
Emergency section for 840-cycle supply from three gen.
Control panel for sequence starting of four generators
Dry-disc rectifiers
Control relays
Motor starting relays
Relays for coil circuits of 840 ∿ line contactors
Control potentio-meters
Manual control for each M-G set
2-Pole CB's for internal buses
2-Pole CB's for disconnect and protection of individual feeders to 840-cycle panels
Gen 4
Gen 5
ΦA ΦB ΦC
Gen 6
Gen 7
Eight 3-pole, 40-amp magnetic contactors (two per generator) serve as automatically controlled line switches supplying main buses in bottom of enclosure
Control current transformers
Phase A
Phase B
Phase C
300-A main CB
Bsmnt
1st floor
2nd floor
3rd floor

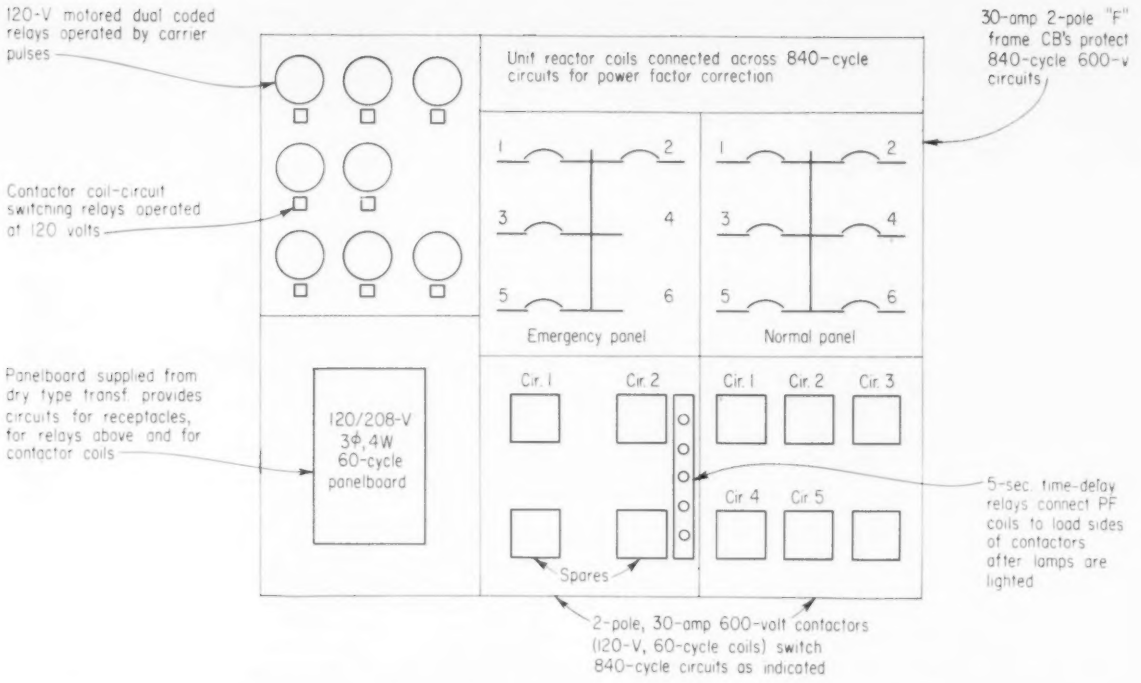
J—HI-CYCLE SWITCHBOARD contains control equipment for operation of both normal and emergency 840-cycle generators. Section shown here is for four 840-cycle normal supply generators. Section for three generators supplied from emergency bus in main switchboard is similar to this. Control equipment provides manual starting of motor for first M-G set and manual connection of the generator to main bus in the hi-cycle board through a pair of magnetic line contactors (total of six poles) in top section at right. With first generator operating, one current transformer on main bus senses load increase beyond capacity of first unit and operates through dc relay circuit to start motor of second M-G set and, when generator is up to voltage, to connect second generator to bus through second set of magnetic line contactors. Automatic sequencing of operations brings all four 840-cycle generators onto main bus in the board. Circuit breakers in bottom of board provide protection and disconnect for mains and for feeders to floor panels. Output from each generator is carried in conduit to switchboard.

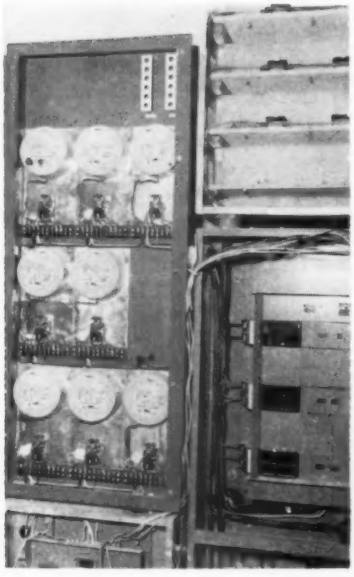


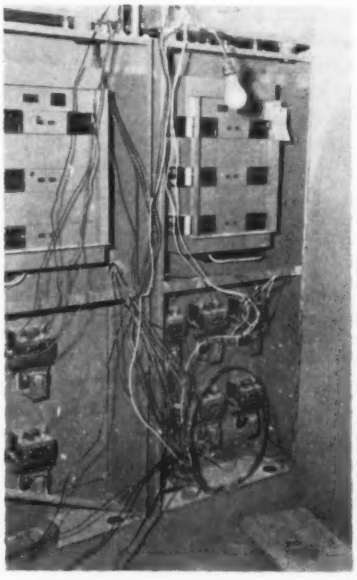
840-CYCLE DISTRIBUTION scheme for four normal generators includes load balancing of main buses and complete separation of phases from generators. Arrangement is distribution complements layout of individual branch circuits to balance loads on phases for operation of luminaires in even a small section of one floor. Automatic carrier frequency control further facilitates operation of loads in balanced blocks. Circuiting of system grounding network runs from the generators to the branch circuit panels.



RISER DIAGRAM of overall electric system in building indicates both 60-cycle and 840-cycle feeder circuiting. Main switchboard and hi-cycle distribution board are shown divided into normal and emergency sections. Normal 840-cycle lighting circuits are served from a panel on each floor—designated by "A" here, i.e. "BA", "1A", etc. Lighting from emergency section of hi-cycle board is served from panels designated "EA", i.e., "BEA", "IEA", etc. Each floor is supplied completely from one electric closet containing a normal 840-cycle panel, an emergency 840-cycle panel and a 60-cycle, 120/208-volt, 3-phase, 4-wire panel for receptacle circuits, incidental lighting and the coils of the 2-pole magnetic contactors switching the 840-cycle, 600-volt lighting circuits. Feeder sizes to lighting panels indicate the efficiency advantage of high frequency operation as reflected into the supply system. All of the 60-cycle panels—designated "P", i.e., "BP", "IP", etc.—are fed from the emergency section of the main 480-volt switchboard. This was necessary to provide power for contactor operation of circuits when the normal supply to the main is out and the diesel generator is feeding the emergency section of the main board. And the carrier frequency oscillator is tied into the emergency section of the main board to transmit control pulses to the dual coded relays over the 60-cycle feeders to the 120/208 volt panels and to the electronic relay motors over the 60-cycle branch circuits. This operation then obtains both when the normal service is feeding the two sections of the main board and when the diesel generator feeds only the emergency section. Under normal conditions, emergency 840-cycle circuits operate as normal circuits, sharing the lighting loads on the different floors but operating completely independent. On each floor, emergency circuit lamps are interspersed among normal circuit lamps to provide widespread lighting under emergency conditions.


120-V motored dual coded relays operated by carrier pulses
Contactor coil-circuit switching relays operated at 120 volts
Panelboard supplied from dry type transf. provides circuits for receptacles, for relays above and for contactor coils
120/208-V 3φ, 4W 60-cycle panelboard
Unit reactor coils connected across 840-cycle circuits for power factor correction
30-amp 2-pole "F" frame CB's protect 840-cycle 600-v circuits
1 2 3 4 5 6
Emergency panel
Normal panel
Cir. 1 Cir. 2
Cir. 1 Cir. 2 Cir. 3
Cir. 4 Cir. 5
Spares
5-sec. time-delay relays connect PF coils to load sides of contactors after lamps are lighted
2-pole, 30-amp 600-volt contactors (120-V, 60-cycle coils) switch 840-cycle circuits as indicated





ELECTRIC CLOSET layout in basement is similar to that on each floor, consisting of normal and emergency branch circuit CB panelboards, magnetic contactors in enclosures, dual coded relays for ON-OFF control by carrier frequency pulses from central operations panel of program system and a 60-cycle 120/208-volt branch circuit panelboard. Carrier pulses operate coded relays which are motor driven on circuits from 120/208-volt panel. Operation of coded relay energizes 120-volt coils of auxiliary relays which are also on 120-volt circuits. Contacts in auxiliary relays switch 120-volt circuit to coils of magnetic contactors controlling 840-cycle circuits. In emergency panel, only circuits 1 and 2 are contactor controlled. Circuit 3 is controlled at the branch CB. Circuit 5 is a spare. In normal panel, circuits 1 to 5 are contactor controlled; and circuit 6 is a spare. Coded relays are provided for emergency circuits 1, 2 and 5 and for normal circuits 1, 2, 3, 4 and 5. Photos at left show construction details of sections of equipment.

277-volt metal enclosed type of dead front construction. This board has a split bus construction to form a normal section and emergency section. Normally both sections of the board are in use. Upon failure of normal supply to the board, an automatic transfer switch in the board disconnects the emergency bus section from the normal bus section and connects it to the output of the emergency diesel generator. Together, the bus sections of the main switchboard supply feeders to 60-cycle power loads, feeders to local step-down transformers and the motor branch circuits to the frequency conversion M-G sets. The bus is tapped by circuit breakers for disconnect and overload protection for all of the circuits. For each M-G set, a CB in the board provides branch circuit protection and motor disconnecting means. A motor starter for the motor end of each M-G set is also mounted in the board.

Another dual section switchboard mounted in the electric room provides protection, disconnect and automatic control of high frequency feeders to lighting panelboard locations throughout the basement and four floors of the building. This board has one section fed by four 30-kw frequency generator sets for normal use only and a second section fed by three 30-kw units for use both under normal conditions and when emergency power is derived from the diesel generator. Control equip-

Normal 840-cycle lighting panel in basement

Panel BA 600 v 3 ϕ		
1	Clg. Ltg. 7150 w.	
2	" " 7000 w.	
3	" " 7200 w.	
4	" " 5200 w.	
5	" " 5500 w.	
6	Spare	

Emergency 840-cycle lighting panel on second floor

Panel 2 EA 600 v 3ϕ		
1	Clg. Ltg. 4000 w.	
2	" " 4800 w.	
3	" " 2500 w EM	
4	Spare	

① All CB's - 30-amp, 2-pole, "F" frame
② All circuits controlled by relay operation of contactors
③ Circuit No. 3 in each emergency panel has no contactor and must be controlled at the panel

General purpose power panel on first floor

Panel 1P 120/208 3 ϕ				
1	4 C.O.		5 C.O.	2
3	5 C.O.		3 C.O. + 375 w.	4
5	5 C.O.		7 C.O.	6
7	6 C.O.		5 C.O.	8
9	5 C.O. + 150 w.		4 C.O.	10
11	6 C.O.		7 C.O.	12
13	Spare		Side ent. grille 1/2 hp	14
15	Spare		Folding doors 2-3/4 hp	16
17	Front Lts. 1550 w.		" " 2-3/4 hp	18
19	Fuel oil pump 1/4 hp		Front ent. grille 1 hp	20
21	P.A. system			
23	Spare			
25	Spare		Spare	26
31	Spare		Spare	32

① All CB's — 20-amp, 1-pole
② C.O. — Convenience outlet

TYPICAL SCHEDULES for electric closet panels show single-line makeup of 840-cycle panels and actual layout of 60-cycle panel. Basement normal lighting panel "BA" has the most heavily loaded circuits of any panel in the building. Circuit 3 with 7200 watts at 600 volts is the most heavily loaded 840-cycle circuit, drawing about 12 amps full load under corrected P. F. conditions. Circuit conductors are No. 10's.

ment in this switchboard turns the M-G sets on and off to meet variations in load requirements. And this control is tied into the overall carrier frequency program control.

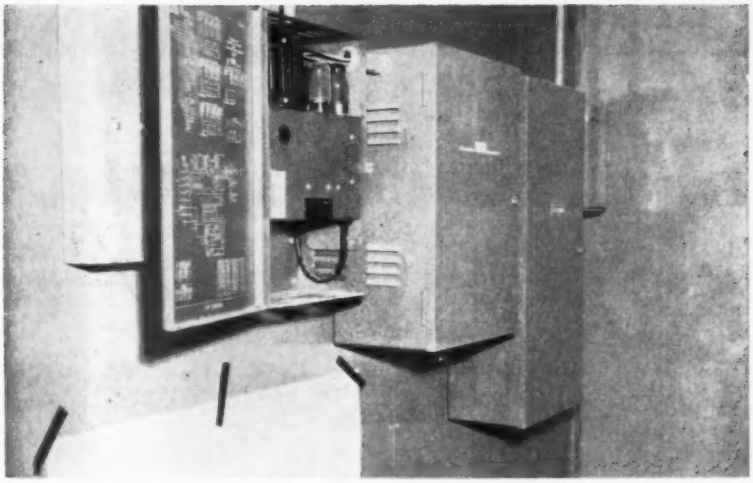
A total of seven motor generator sets provide the total of 200-kw capacity of 840-cycle, 600-volt power to the high frequency switchboard. Each M-G set is fed by a 480-volt, 3-phase, 3-wire circuit in conduit from the main 480-volt switchboard. The 840-cycle output circuit from each generator consists of three pairs of conductors—each pair constituting an individual 2-wire, single-phase, 600-volt circuit. The three phases from the units are maintained separate throughout the system. The output from each generator is carried in conduit to the hi-cycle switchboard.

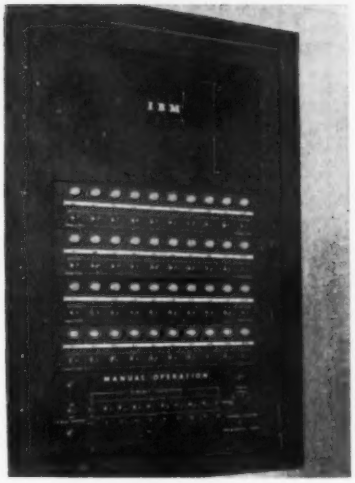
These frequency conversion units were considered part of the hi-cycle lighting system. Their function constitutes a form of ballasting for the lamp loads they supply. They were supplied as part of the overall high frequency lighting system which was manufactured by The Wakefield Company, who make 840-cycle lighting available as a complete system requiring only wiring between components and connection of the converters to standard 60-cycle supply circuits.

As shown in accompanying illustrations, feeders from the hi-cycle switchboard in the second floor electric room are carried to electric closest load centers on the various floors. At each closet, the basic layout of equipment includes: (1) a circuit breaker panelboard for the 600-volt high frequency circuits, (2) cabinet-mounted magnetic contactors for switching the circuits, (3) an enclosure containing dual-coded relays which control the operating coils of the contactors in response to signal pulses from the central operations panel of the carrier frequency program system, (4) unit shunt reactors mounted in cabinets and connected into the branch circuits on the load sides of the contactors, and (5) a 120/208-volt general purpose branch circuit CB panelboard for receptacle circuits, with one circuit for supplying the 120-volt contactor coils.

Circuiting of the high frequency lighting units is made at 600 volts line-to-line for each circuit. However the mid-point of each phase winding in each 840-cycle generator is grounded, which limits the voltage of each circuit conductor to no more than 300 volts above ground. This limitation is imposed by section 2113 of the National Electrical Code. All wire used on high frequency circuits was downrated 50%. Branch circuit conductors are not smaller than No. 10. A minimum of No. 6 conductor was set in the specs for hi-cycle feeder circuits. In addition to the protection provided by the branch CB's, each group of lamps (25 to 50) is protected by a low lag cartridge fuse rated for 150% full load.

The high frequency distribution system was designed to give positive starting for 4-, 5-, 6- and 8-ft instant-start fluorescent lamps. For ballast, a small capacitor is placed in series with each fluorescent lamp to provide a 600-ma current through the lamps. These capacitor units are made specifically for operation of the associated lamps at the given circuit voltage. Use of capacitors for ballasting of individual lamps produces a low, leading-current power factor which, if not corrected, would load down the frequency converters. It is necessary to maintain power factor at not less than 85% at full load for the line into which the converters work. And this must be regulated so the hi-cycle current does not exceed the maximum load conditions of the converters. To compensate for the leading reactive current of series capacitance, shunt inductive reactance is used. For this installation, this took the form of unit reactor chokes each of which draws a lagging current





PROGRAM CONTROL for load operations throughout building is provided by IBM carrier frequency system which consists of electronic transmitter and associated equipment mounted on back of main 480-volt switchboard (left), central operations panel in building engineer's office (right) and various receivers located at the points of controlled loads. Carrier frequency pulses from the transmitter are triggered from the operations panel in accordance with a preset program. The pulses are coupled into the emergency bus section of the 480-volt board through capacitors which represent a low-impedance path in the direction of the current flow from the transmitter to the bus, but are effectively open-circuit for 60-cycle energy flow from the bus to the transmitter. All control pulses are carried on the 60-cycle circuit conductors to devices which respond to the signals. Central operations panel contains master clock which times and schedules all operations, calendar mechanisms for scheduling operations for days of the week, switches and pilot lights for control circuits.

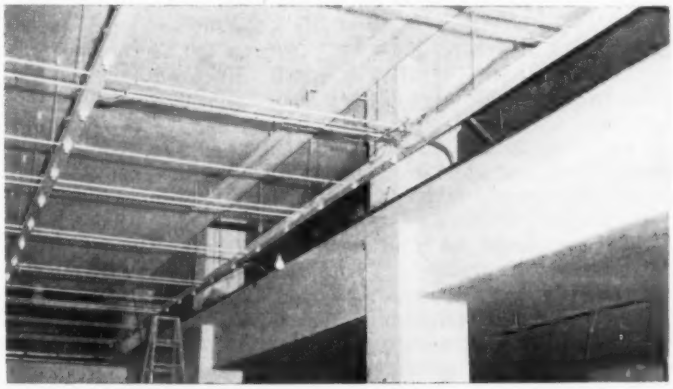
approximately equal to the leading current of the capacitive load.

Generally, switching of high frequency branch circuits is provided by the coded relays mentioned above. These units receive their carrier frequency operating pulses over the wires used to distribute 60-cycle electric power from the main 480-volt switchboard to the 120/208-volt panel adjacent to the relay enclosure in each electric closet. The carrier frequency pulses are transmitted from the bus in the main switchboard through 480—120/208-volt transformers and along feeder and branch circuit conductors to the sensing device. The coded relays actuate contactors in the 2-pole, hi-cycle circuits. Although this switching is normally automatic on a pre-determined schedule, manual switching of circuits can also be obtained with the carrier frequency system. In some areas, where lighting will not be used at regular intervals, switching of the lamps is made by local 2-pole, 20-amp, 600-volt tumbler switches. In all cases of switching, power factor is corrected before switching.

Distribution for 60-cycle power to air conditioning equipment and other motors is fairly conventional. Feeders originate in the main 480-volt switchboard and are carried directly to power loads at 480 volts. Supply to 120/208-volt general purpose panels is made through local step-down transformers fed from the main switchboard. Dry-type transformers are used, mounted with vibration absorption material to prevent amplification and transmission of sound vibrations. The secondary neutral point of each 3-phase stepdown transformer is grounded to the nearest water pipe.

Emergency power is tapped from the main bus in the 480-volt switchboard. If this supply should fail, the emergency load is picked up by the diesel generator. The emergency power load in the building include:

1. Exit and emergency lights in corridor and elevators.
2. Up to 50% of lighting in vaults, cash, fiscal, accounting and part of transit department where work cannot be interrupted.
3. Minimum lighting to prevent a panic in the event of a failure.
4. Intercom and public address.
5. Air conditioning fans.
6. One elevator.
7. Sewerage lift pump.
8. All IBM machines and floor or wall outlets required for continuation of critical work.



CONSTRUCTION DETAILS are shown at lighting units where large area luminous ceiling is lighted from lamps mounted on preassembled wiring channels with spacer conduits carrying wiring between lampholders on channels. The high frequency ballasting capacitors for each pair of lamps are mounted in the channels. Channels are rod-suspended from slab above. Large-area, low-brightness lighting equipment was provided by The Wakefield Company as part of the high frequency lighting system. Finished installation has plastic diffusers suspended below the lamps.

ESTIMATING FORUM-XI

Operating Cost-One-Third Volume Rule, How to Use It

By Ray Ashley, *Research and Consulting Engineer, Oak Park, Ill.*

QUESTION:

What is The One-Third Volume Rule?

ANSWER:

The One-Third Volume Rule states that a contractor cannot expeditiously handle any single project whose volume exceeds one-third his average yearly volume for the preceding three years.

DISCUSSION:

To illustrate the one-third volume rule, let us use the figures of a contractor having the following annual volumes for the past three years:

1955 —	$195,000
1956 —	215,000
1957 —	220,000
Three-year total —	$630,000
Average per year —	$210,000

According to the one-third volume rule, the maximum size single project that this contractor could undertake with impunity would be one-third of $210,000, or $70,000.

Aside from the financial problems encountered on an over-sized job, there are other factors to be considered. The contractor must be able to engineer, superintend and man the project. Unless he normally has been overmanned, he must observe the one-third rule.

We must compare the manpower requirements of the special project with those normally experienced by the contractor. With sound estimating, the base labor cost normally runs from 28% to 33% of the selling price, depending on insurance rates, management markups for profit, etc.

To establish the base labor costs for this illustration, we will use 30% of the selling price of the maximum size project the contractor can handle under the one-third volume rule. Thus, 30% of $70,000 is $21,000. Using a labor rate of $3.50 per hour, this would represent a total of 6,000 manhours.

In the accompanying table, line three shows the manpower requirements (optimum duration) for a project requiring 6,400 manhours (column 7). Here, the average demand (column 20) for the project is 8.5 men; and maximum demand (column 16) for peak period is 12 men. Since we have a 6,000 manhour project, we will use eight as the average and 11 as the maximum number of men required.

The average annual volume of $210,000 (over a 3-year period) must be used to establish the manpower demand normally experienced by this contractor. Again, use 30% of the selling price for base labor cost and the $3.50 per hour rate and follow the procedure noted above.

Then, 30% of $210,000 is $63,000. Divide this by the $3.50 rate and get 18,000 manhours for the average annual volume. Assuming 2,000 hours per man per year, the average number of men employed would be nine (18,000 ÷ 2,000).

Although the contractor normally employs nine men, all of his regular mechanics would not be available for the $70,000 project. Some of them would be on other contract work or taking care of routine calls for regular customers.

Assume that five regular employees were available for the big project. The rest of the crew would have to be picked up in the open market. During the peak period, there would be five regular employees and six (over 50% of total crew) outside men. Under ordinary conditions, one outside man to each seasoned employee is the maximum that can be used to get satisfactory results.

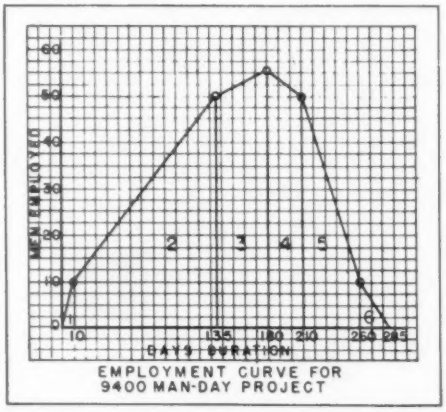
Exceptions: Contractors engaged in certain types of specialized construction work, such as railroad electrification, overhead power lines and the like, must be prepared for volume fluctuations and figure their work accordingly. With careful management, contractors often are able to handle very large contracts for regular customers and in other cases where variables are known.

For further discussion of the "one-third-volume rule" and exceptions, see page 156, Electrical Estimating (McGraw-Hill Book Company).

CONSTRUCTION PERIODS FOR ECONOMIC OPERATION OF ELECTRICAL INSTALLATIONS — INDUSTRIAL

SEE NOTES BELOW

LABOR		CONSTRN. PERIODS-SEE SKETCH BEL.									TOTAL PERIOD		AV.NO OF MEN EMPL.
		1 & 6			2 & 5			4 & 3					
MAN HOURS	MAN DAYS	DAYS	MEN AV.	MAN DAYS	DAYS	MEN AV.	MAN DAYS	DAYS	MEN AV.	MAN DAYS	DAYS	WKS.	
7	8	9	10	11	12	13	14	15	16	17	18	19	20
1,250	156	10	2	20	12	4	48	15	6	90	37	7.4	4.2
3,150	394	12	2	24	35	6	210	16	10	160	63	12.5	6.3
6,400	800	12	2	24	52	8	416	30	12	360	94	19.	8.5
13,600	1700	15	4	60	75	12	900	37	20	740	127	25.4	13.4
28,000	3,500	20	4	80	125	16	2,000	60	24	1,440	205	41	17.1
44,000	5,500	30	5	150	145	22	3,190	60	36	2160	235	47	23.4
59,500	7,440	30	5	150	160	26	4,160	70	45	3,150	265	53	28.5
75,000	9,375	35	5	175	175	30	5,250	75	53	3,975	285	57	33.
90,000	11,250	40	5	200	185	34	6,290	80	60	4,800	305	61	37.
112,500	14,060	42	7	294	225.	37	8,325	85	64	5,440	350	70	40.
150,000	18,750	45	11	495	270	45	12,150	85	72	6,120	400	80	47.
190,000	23,750	50	14	700	295	54	15,930	90	80	7,200	435	87	54.5
230,000	28,750	60	15	900	300	66	19,800	90	90	8,100	450	90	64.
267,000	33,375	65	16	1,040	304	72	21,888	95	110	10,450	465	93	72.
305,000	38,125	70	18	1,260	310	79	24,490	100	125	12,500	480	96	80



EMPLOYMENT CURVE FOR 9400 MAN-DAY PROJECT

ESTIMATED OPTIMUM DURATION FOR A JOB REQUIRING 9400 MAN-DAYS

PERIOD	DAYS	NO. OF MEN-AV.	MAN DAYS
1	10	5	50
2	125	30	3750
3	45	53	2385
4	30	53	1590
5	50	30	1500
6	25	5	125
TOTALS	285		9400

1.-PERIODS BASED ON PROGRESS FREE OF INTERFERENCE FROM OTHER OPERATIONS 2.—CONTRACTOR MUST BE MANNED, EQUIPPED AND ORGANIZED TO EXPEDITIOUSLY CARRY ON THE WORK. 4-24-56

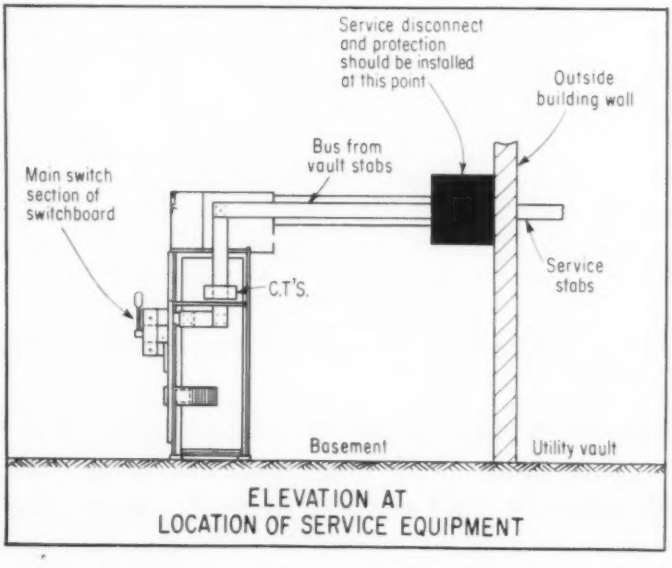
New York City seeks safety in . . . . .

High Capacity Secondary Services

A rundown on proposed official clarifications of New York City's electrical code designed to insure safe installation of secondary voltage services of high current rating. Also included are comments by Eitingon & Schlossberg Associates, consulting electrical engineers, New York, N. Y., who are thoroughly experienced in the many problems arising from high current services. The discussion here is of wide interest in many cities and areas where service capacities are growing rapidly.

NEW YORK CITY is hard at work on the problem of minimizing potential hazards to life and property due to service entrances with high available short-circuit currents. At various meetings, representatives of all segments of the industry—consulting engineers, electrical contractors, electrical code and inspection authorities and electrical manufacturers—have studied and discussed the problem of providing safe and effective equipment installations for high capacity services. These discussions correlated the various elements required in a service arrangement—short circuit protection with sufficient interrupting capacity, location of this protection for maximum effectiveness, disconnect means with adequate interrupting ability and ready accessibility of the disconnect for effectively isolating the electrical system from its supply. Economy considerations pitted the switch against the CB; operating realities divided service protection into two distinct needs —operating overload and short circuit; use of unswitched fuses at service stabs offered some advantage; use of remote-control for disconnect seemed to have a lot of merit. The overall problem is complex. But discussion continues and progress has been made.

Proposed Bulletin 11 of the New York City Department of Water Supply, Gas and Electricity covers rules for assuring maximum safety in large capacity secondary services. It applies to service equipment, service feeders, switchboards and switchboard rooms for operation at 120/208 volts or 460/265 volts. These proposed requirements constitute one set of conclusions from the continuing discussion. In the Bulletin, they are described as supplemental and clarifying regulations which establish specifics of minimum installation methods. However, additional safeguards may be required to meet the conditions of a particular job. To assure clear understanding of the requirements set forth, the bulletin has a prefatory section of definitions of important terms. These are shown in an accompanying list.



ELEVATION AT LOCATION OF SERVICE EQUIPMENT

DEFINITIONS OF TERMS

SERVICE DISCONNECTING MEANS is a switch or circuit breaker (with or without overcurrent tripping device) to be located directly at and connected to the electric utility company's service terminals (stabs).

SERVICE STABS are the electric utility company's end terminals located at the point where customer accepts electric service.

SERVICE INTERRUPTING FUSE is a current-limiting fuse of the "silver-sand" type, or other type of fuse with equivalent performance, to be located directly at the service entrance (service stabs) and capable of interrupting the maximum short-circuit current available at this point.

SHORT-CIRCUIT CURRENT shall mean the current available under "bolted" short-circuit conditions.

BUS is a solid conductor whose form may be a rectangular flat bar or a tube of rectangular or circular cross-section.

BUSWAY is an assembly consisting of a group of busses enclosed in a suitable metal housing. The busses are arranged in a pattern depending on the service intended and each bus is mounted on insulating supports which effectively hold the bus group in the required pattern.

SERVICE BUSWAY is a busway designed for use between the service equipment at the service stabs and the main switchboard. Each bus-bar of a service busway shall be individually covered with approved insulation for its entire length.

The major provisions covering service installations are as follows:

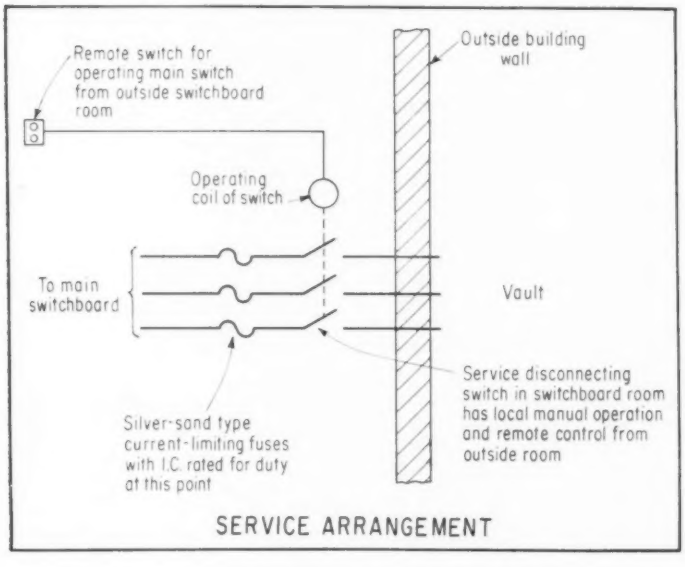
SERVICE EQUIPMENT (Over 1200 amps)

A. Each service feeder, whether of the busway type or insulated-conductors-in-raceway type, designed for more than 1200 amps, shall be protected directly at the service takeoff (service stabs) by a service disconnecting means and service interrupting fuses of adequate and coordinated design.

B. The service disconnecting means may be a pressure-contact switch or a circuit breaker of adequate design. The disconnecting means shall be of the dead-front type. It shall be capable of opening under 150% of its rated current at rated voltage, many times, without damage. When installed in service with the necessary overcurrent protection, it shall carry its rated load without exceeding a temperature rise of 30°C.

C. If located in the switchboard room, the service disconnecting means, in addition to having local manual operation, shall be designed and installed for remote operation from outside of the switchboard room, by either mechanical or electrical controls. When located outside of switchboard room, a service disconnecting means shall be directly accessible from a public space, without obstructions.

D. Service interrupting fuses shall be of the silver-sand type or equal in performance. They shall be of the current-limiting type with high-current interrupting capacity and capable of interrupting the maximum available short-circuit current to which they may be subjected.


Remote switch for operating main switch from outside switchboard room
Outside building wall
Operating coil of switch
To main switchboard
Vault
Service disconnecting switch in switchboard room has local manual operation and remote control from outside room
Silver-sand type current-limiting fuses with I.C. rated for duty at this point
SERVICE ARRANGEMENT

SERVICE BUSWAY

A. The bus structure of a busway may consist of copper or aluminum conductors mounted in approved insulating supports properly spaced and braced to withstand the maximum stress of short-circuit currents to which the bus structure may be subjected. Busways shall be installed with adequate provisions for expansion and contraction to avoid stresses under expected conditions of loading.

B. The busway enclosure may be of aluminum or steel and may be provided with ventilating panels. Steel enclosures may be used only for busways rated at not more than 1000 amps, unless the conductors are interleaved, to keep heating due to induction within safe temperature limits.

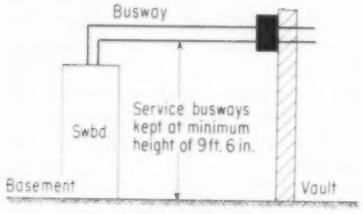
C. Bus joint surfaces shall be ground smooth and silver-plated by the electric process. Joints between busses shall be made by means of clamping or bolting devices which will automatically maintain contact pressure under all conditions of normal operation.

D. The complete busway shall be capable of carrying its rated current and rated voltage, continuously, without exceeding a temperature rise of 55°C above a 30°C ambient, when mounted in any position required by job conditions.

E. A dielectric strength test shall be performed on each section and each fitting of the busway before it is shipped to the job site. Tests shall be made at not less than 2200 volts ac, 60 cycles between each bus and grounded enclosure and between "live" parts of opposite polarity.

F. Busways may be used only for exposed installations. Minor deviations from this rule may be approved, if justifiable, to meet peculiar field conditions.

G. In the case of service busways each bus shall be individually covered with approved insulation for its entire length. This includes that part of bus which passes through the insulating support. Bus joints may be insulated with removable molded covers.

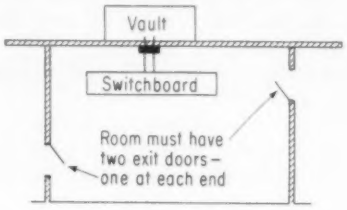


SERVICE BUSWAY

H. Horizontal service busways shall be kept at a minimum height of 9 ft 6 ins. above floor to the underside of busway enclosure, except where connections are made to service equipment or switchboard.

SWITCHBOARD ROOMS (Service over 1200 amps)

A. The switchboard room shall be provided with at least two separated means of egress located at opposite ends of the switchboard room, affording direct and safe access to a public space.



PLAN OF SWITCHBOARD ROOM

B. All component parts of switchboards or main distribution boards connected to the load end of service feeders shall be designed and constructed to safely withstand the maximum mechanical stresses and electrical impact to which these component parts may be subjected under bolted-fault short-circuit conditions.

C. A thermostatically actuated alarm system audible to responsible personnel shall be provided to give warning of a rise in the temperature of the switchboard room beyond 50°C. The alarm circuit shall be supplied from a separate fused tap placed on the service side of the interrupting fuses.

D. If, because of special conditions, service disconnecting means are permitted to be installed on switchboards, these shall be of the dead-front type. A switch or circuit breaker and its associated fuses shall be mounted on the same side of the switchboard, either front or back.

GROUNDING

A. Although it is essential that proper equipment grounding be provided for all types of electrical service, it is particularly important that grounding procedures be carefully engineered in the case of ac services larger than 1200 amps. In every case, the grounding path must have an impedance low enough to pass sufficient current in excess of that required to open the overcurrent device.

B. It has been ascertained that using the structural steel of a building for equipment grounding purposes results in a grounding path of relatively high impedance. Therefore, this method of grounding will not be permitted for high current capacity installations.

C. Service interrupting fuses shall be located directly at the service stabs and the service equipment ground connections as direct as possible to insure a low-impedance grounding path.

D. Busway sections shall be connected to one another in a manner to provide a low-impedance grounding path to assure operation of the overcurrent device as intended. If the impedance path of the busway enclosures is not low enough, reinforcing ground bars shall be provided in parallel to reduce the impedance of the grounding path.

E. Switchboards shall be provided with a ground bus placed as close as practical to the phase busses to keep the mutual impedance at as low an impedance as possible. Frames and steel panels shall be grounded effectively.

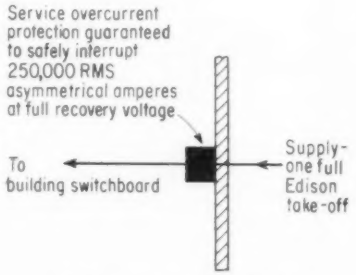
Engineers' Analysis

In response to the above Bulletin 11, one consulting electrical engineering firm in New York City offered their comments in a spirit of industry cooperation. This was the firm of Eitingon & Schlossberg Associates. Expressing their deep interest in and entire agreement with the intent of the Bulletin, they set forth recommendations based on engineering analysis and their experience. These comments proposed practical ways by which the Bulletin provisions can be effectively fulfilled. They were formally submitted to the Commissioner of the Department of Water Supply, Gas and Electricity.

The following are the comments of Eitingon & Schlossberg Associates:

1. The Department should require that all large main service overcurrent devices have guaranteed interrupting capacity ratings of 250,000 RMS amperes.

The provisions of the Bulletin, requiring close proximity of the service disconnect means and overcurrent protection to the electric utility company service terminals, eliminate the possibility of intro-


Service overcurrent protection guaranteed to safely interrupt 250,000 RMS asymmetrical amperes at full recovery voltage
To building switchboard
Supply-one full Edison take-off

SAFETY RECOMMENDATION

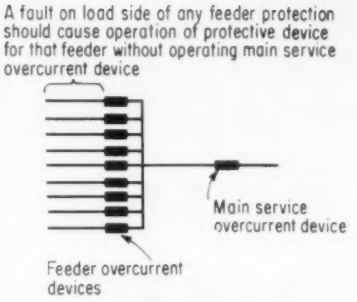
ducing high reactance, current-limiting bus or other such elements into the system. These provisions thereby throw the entire burden of interrupting the utility company's deliverable short circuit currents upon the service overcurrent protection devices. Since the various calculations which we have made for different projects (based on utility company system impedance values furnished to us by the Consolidated Edison Company) indicate that such short circuit currents may exceed 200,000 RMS assymetrical amperes, and since most of the interrupting capacity information regarding overcurrent devices available from manufacturers is not presented with guarantees, where such high currents are involved, we believe that the Department should publish a standard requirement that all main service overcurrent devices, for service installations consisting of one or more full Edison take-offs, shall be guaranteed to safely interrupt 250,000 RMS asymmetrical amperes at full recovery voltage.

We believe that the enforcement of this requirement on all services, as mentioned above, is not unreasonable, due to the fact that the Edison Company's continuing reinforcement program may tomorrow introduce these high short circuit currents into buildings where they do not exist today.

If investigation shows that guarantees of the nature required will not be forthcoming from the manufacturers, it may be necessary for the Department to approach the Edison Company with the idea that they should establish practices to limit the available short circuit currents at service take-offs to a value which the manufacturers will guarantee their overcurrent devices can handle.

2. The Department should indicate a preference for a coordinated selective system of overcurrent protection for main service and feeder installations.

Compliance with the recommendations mentioned in Item 1 above, may possibly be achieved by the use of fast acting high interrupting capacity main service fuses backing up conventional systems of feeder overcurrent protection. Such installations are non-selective and reflect feeder faults through to the main overcurrent devices. Since loss of main service in any large building frequented by the public,


A fault on load side of any feeder protection should cause operation of protective device for that feeder without operating main service overcurrent device
Main service overcurrent device
Feeder overcurrent devices

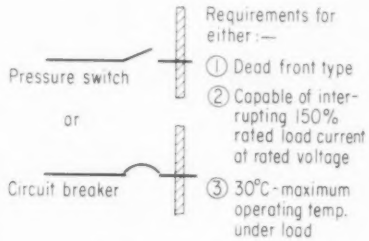
COORDINATED SELECTIVE PROTECTION

may in itself represent serious hazards and financial loss, the Department may feel it desirable to show preference for a coordinated selective system of overcurrent protection throughout a switchboard and service installation. Each element of such a coordinated system can handle the maximum short circuit current and will take out of operation only the faulted part of the electrical system.

3. The Department should indicate more complete requirements regarding the construction of service switches.

After careful consideration, we have come to the conclusion that both New York City and National Electrical Codes give a general approval to the use of an isolating switch as a service disconnecting means. We have always considered that a general acceptance of an isolating switch for a service disconnecting means is not satisfactory, and we are very gratified to note that Bulletin 11 attempts to place more stringent requirements on the construction of an isolating switch so that it will be suitable for a service disconnecting switch. We feel, however, that Bulletin 11 is not complete enough in outlining these requirements.

The paragraph stating that a service switch shall be capable of opening under 150% of its rated current at rated voltage many times, without damage, should be


Requirements for either :—
Pressure switch
① Dead front type
② Capable of interrupting 150% rated load current at rated voltage
or
Circuit breaker
③ 30°C - maximum operating temp. under load

SERVICE DISCONNECT

revised to read: "The switch shall be capable of opening under 150% of its rated current at rated voltage and 80% power factor, at least 50 times without the need to redress the main blades to maintain rated continuous characteristic (i.e., temperature rise), or to redress or replace any auxiliary arcing contacts to assure their proper functioning as protection for the main blades.

4. The Department should make additional requirements regarding the remote control and operation of main service disconnecting means.

We believe that a remote control device for opening the main service disconnect means is an excellent suggestion which should not be limited to disconnect means located in switchboard rooms, but should be furnished immediately outside the entry to any space in which the disconnect means is located. The remote control device should be a break glass switch to avoid accidental operation.

We recommend the posting of instructions calling for periodic operation of the main disconnecting means through its remote control, to prevent freeze up. The instructions should require that a record be kept attesting to such operations and should limit the time of operations to periods of light load.

5. The Department should revise the permissible temperature rise ratings of service busways.

In the Bulletin there is an indication that service busways be permitted a 55°C rise over ambient 30°C. We do not believe this is wise since with the service disconnect properly rated at no more than a 30°C rise, heat will flow from the busway into the switch.

6. The Department should permit a specified maximum distance between service stabs and main disconnect means and overcurrent devices.

The Bulletin states that the service disconnecting means and overcurrent protection shall be located directly at the service take-off. We believe that this requirement should be modified to the extent that a maximum permissible length of bus or unencased conduit be specified between the utility company service terminals and the main service disconnecting means and overcurrent protection. Such a maximum length should be established somewhere between 5 and

[Continued on page 134]

Research Reveals Need for

HIGHER LIGHTING INTENSITIES

Eight-year study at University of Michigan's Vision Research Laboratories results in new optical device and measuring technique for determining lighting needs, provides new scientific basis for markedly higher illumination levels than are now recommended.

By Berlon C. Cooper

ONE of the most dramatic and significant developments that has occurred in the lighting industry since Edison's invention of the electric lamp 79 years ago, was unveiled and reported on earlier this year. It is a new evaluating system for determining, scientifically, the amount of light required to perform any practical seeing task comfortably and efficiently. The new system, which indicates the need for moderate to sharp increases in recommended lighting levels for a broad variety of specific visual tasks encountered in standard lighting practice, is the result of an 8-year comprehensive study conducted at the Vision Research Laboratories of the University of Michigan. This study was made, and is being continued, under the supervision and guidance of Dr. Richard H. Blackwell, director of the Michigan laboratories, and a team of University of Michigan research specialists in optics and psychology (see "Lighting Breakthrough" by Wm. T. Stuart, page 55, *EC&M*, April, 1958). It has already become known, and is commonly referred to, as the "Blackwell Report".

TABLE I — Footcandle Values for Various Office Visual Tasks

Task Description	R	Visual Capacity (APS) 1	3	5	7	10
Sample of shorthand copy with No. 3 pencil	.79	6.32	30.4	76.5	133	304
Typed original, good ribbon	.62	0.48	0.71	0.97	1.34	1.94
Typed carbon, fifth copy	.53	10.2	54.4	133	243	544
Thermofax copy, poor quality	.63	20	258	589	1230	2760

Suprathreshold Visibility Factor 15
99% Accuracy (Maximum Practical)
APS – Assimilations per Second

The New System

Dr. Blackwell began developing his new system in 1950, with a painstaking series of studies to establish how accurately a variety of subjects could determine the presence of circular targets of diverse sizes exposed to view for varying periods. The targets were designed to simulate various degrees of "difficulty" in seeing specific objects under varying conditions. Scores of thousands of readings were recorded and carefully catalogued. These data became the cornerstone of the system which is based on the scientific fact that "an identical amount of light is required to perform any visual task of total equal difficulty". Thus, Dr. Blackwell explains, "if the lighting engineer knows the amount of light required to perform a given visual task, he can accurately specify the amount of light required by another task equally difficult to see".

To relate his accumulated basic data to any given seeing task, Dr. Blackwell developed a complex optical instrument which he calls a

FIELD TASK SIMULATOR is one of the devices designed, constructed and used by Vision Research Laboratories, Univ. of Michigan, to provide needed data in study to determine how much light is needed to see various visual tasks comfortably and efficiently.

Visual Task Evaluator (VTE). With this device he can view a seeing task of unknown lighting requirements at threshold—or just bare visibility—match it to a test object of known lighting requirements, and quickly determine the lighting requirements for the seeing task from the collected statistical data. The indicated lighting requirement thereafter needs only simple mathematical adjustment to compensate for the differences between the standard data, collected under optimum laboratory conditions, and actual conditions in the field.

How Eye Sees

While conducting his 8-year study, Dr. Blackwell recognized that the average eye sees or "assimilates" visual information by bits, and that the level of illumination determines the number of assimilations the eye can make in a one-second interval. He states that the average eye "is easily capable of making ten such assimilations a second if the light level is sufficiently high".

The number of assimilations per second determines the amount of information the eye has absorbed, "and the more information the eye has absorbed, the higher the rate of performance is likely to be", according to Dr. Blackwell.

Illumination Levels

Included in the Blackwell Report are summary data covering recommended illumination levels for 56 practical visual tasks. For each of these visual tasks, illumination values are given for five different values of visual capacity, or Assimilations Per Second (APS) that is, for APS of 1, 3, 5, 7 and 10. Table I gives data from the report for four visual tasks encountered in offices.

In reporting on the application of the Blackwell technique to IES Recommended Lighting Practice recommendations, C. L. Crouch, IES Technical Director, states that the Society's technical committees have adopted five assimilations per second (APS) as a reasonable average level of desired performance.

In its interpretation of the Blackwell data, the IES Committee on Recommendations of Quality and Quantity of Illumination has listed the 56 visual tasks covered in the report in terms of visual task difficulty as obtained by actual measurement. These are: easy, ordinary, difficult, very difficult, and most difficult. This listing will serve as a basis for the classification of unrated visual tasks. Typical examples are given in Table II. The Committee has also established brightness ranges for these five levels of task brightness, which are given in Table III.

In establishing new recommended illumination values, IES technical committees have been asked to consider engineering judgment based on economic factors, and to conform footcandle values into a sequential order of 10, 15, 20, 30, 50, 70 and 100 (x 0.1, x 1, x 10, x 100, and x 1000 as required). The new footcandle values so determined will be published in the Society's revised edition of the IES Lighting Handbook, due to be released early in 1959.

Representative of the range of necessary lighting intensity modifications indicated by the new measuring technique are the following:

- For desk-level illumination for an accountant, an increase in footcandles from the presently-recommended 50 to a minimum of 150;
- In school tasks involving writing with soft-lead pencils, an increase from the presently-recommended level of 30 footcandles to 60;
- For the work area of a draftsman, a fourfold increase over present recommendations is indicated—from 50 to 200 footcandles;
- In the garment industry, need for greater footcandle increases is indicated. For example, for such tasks as viewing orange chalk markings on light brown tweed, the system shows a required 266 footcandles, compared with present recommendation of 40 footcandles.
- Initial tests have indicated, however, that no modifications of existing recommendations for many seeing tasks will be necessary.

IES Sponsored Study

Dr. Blackwell's work since 1950 has been supported by the Illuminating Engineering Research Institute, an independent research body of the Illuminating Engineering Society. It is one of several individual, but related, light and vision studies already completed, or now in progress, under IERI sponsorship, which serves as a medium for meshing the basic search for scientific unknowns with the vital

public need to learn the influence of light on living.

The new evaluation system is considered to be the most scientifically accurate and most comprehensive technique for determining the lighting needs of specific visual tasks thus far devised, according to C. L. Crouch.

The new system for determining lighting needs has been described and discussed by Mr. Crouch at the various IES Regional Conferences held during the spring months. It has also been announced that Dr. Blackwell will be on the program at the Society's annual National Technical Conference to be held in Toronto, Ont., Canada, August 17-22, at which time he will further discuss his system in detail.

Some idea of the scope of this research project is revealed in a statement by IES President Kirk M. Reid, who said "Quite possibly in number of observations, research staff, and investment, the Blackwell studies over the past 12 years equal or approach the total of *all* former studies relating lighting and seeing". Observations are estimated at some ten million, the Vision Research Institute has a staff of over 40, and there is an investment of more than $1,500,000 in all areas of vision research.

President Reid aptly summarized the significance of the Blackwell Report in a one sentence statement: "For difficult visual tasks occurring widely in actual practice, there is verification of need, from the standpoint of visibility alone, of markedly higher illumination levels than are now recommended".

TABLE II — Classification of Typical Visual Tasks*

Task Description	Required Brightness (Ft-L)	Reflectance	Required Illumination (Ft-C)
EASY TASKS			
White chalk mark on blue serge cloth	.20	.020	10.4
Gray line defect on black cloth	.66	.024	27.5
Sample of ink writing, one 6th grade student	1.05	.76	1.38
Price tag, ink	2.36	.76	3.10
No. 2 pencil on tracing paper over blueprint	3.88	.59	6.58
White chalk on gray cloth	6.92	.33	21.0
Pattern threads, men's silk and wool suiting	7.24	.22	32.9
Pattern threads, white handkerchief	8.97	.91	9.86
Skip defect, viewed from 16 feet	13.5	.19	71.
ORDINARY TASKS			
Small skip defect, viewed from 30 inches	35.6	.19	187.
DIFFICULT TASKS			
Samples of No. 2 pencil writing	47.8	.76	63.
Orange chalk on light brown tweed	47.9	.18	266.
Dark brown raised threads on silk	58.9	.035	1680.
Sample of shorthand copy with No. 3 pencil	60.5	.79	76.5
Typed carbon, fifth copy	70.7	.53	133.
Brown color difference in cloth	100.	.12	870.
VERY DIFFICULT TASKS			
Price tag, pencil	151.	.63	241.
Thermofax copy, poor quality	371.	.63	589.
MOST DIFFICULT TASKS			
Blue-gray raised threads on silk	447.	.046	9650.
Pocket stitching, tan skirt	1000.	.53	1890.
Chip grain, viewed from 16 feet	1230.	.19	6470.
White line on blueprint, tracing paper overlay	3000.	.59	5090.
Brown thread stitching on brown silk tweed	3000.	.12	10,000.
White chalk on tan cloth	3000.	.24	10,000.
Brown stain on gray cloth	3000.	.12	10,000.

*Taken from the 56 practical tasks in the Blackwell report, and based on five Assimilations per Second (APS), suprathreshold visibility factor 15, and 99% accuracy (Maximum practical).

TABLE III — Five Levels of Seeing Task Difficulty

Difficulty of Seeing Task	Brightnesses (Footlamberts)	60% Reflectance (Footcandles)	6% Reflectance (Footcandles)
Easy	Below 18	30 down	300 down
Ordinary	18-42	30-70	300-700
Difficult	42-120	70-200	700-2000
Very Difficult	120-420	200-700	2000-7000
Most Difficult	420 up	700 up	7000 up

Footcandles depend upon reflectance of visual task. Task brightness divided by reflectance equals footcandles needed.

Industry's Responsibility

Impact of the Blackwell studies on the lighting industry will be great. Just how great will be determined by how the new data are interpreted and used by the industry. The manufacturers of light sources and lighting equipment are studying the data, and discussing it at length and in detail, in an effort to interpret and relate the new data to their own respective operations. Consulting engineers, lighting consultants, electrical contractors and others will be interested in the data, and how they can apply and use them.

In recent years, the lighting industry has been placing major emphasis on *lighting quality*, rather than on *lighting quantity*, in an effort to improve seeing comfort and to make lighting installations acceptable even at the low lighting intensities then being installed. Now, the Blackwell data provide a new scientific basis for *lighting quantity*, and for higher footcandle recommendations. Key factor will now be required task brightness related to contrast values, under the conditions outlined in the report. This scientific method for establishing footcandle recommendations also takes the charge of "too high lighting levels" off various segments of the industry on a self-interest basis. Properly interpreted by producers, specifiers, sellers, installers and users of lighting equipment, the Blackwell studies can play a vital role in a new and dynamic growth in lighting.

MAXIMUM NATURAL LIGHTING augments 10 watts/sq-ft of artificial illumination in this functional commercial structure wherein all service facilities are concentrated in a center core, thereby leaving peripheral areas unobstructed for planning flexibility. Building is completely air conditioned, served by automatic elevators and powered through substations located at the top as well as in the basement.

Electrical systems installation for . . .

Cleveland's New 24-Floor Office Building

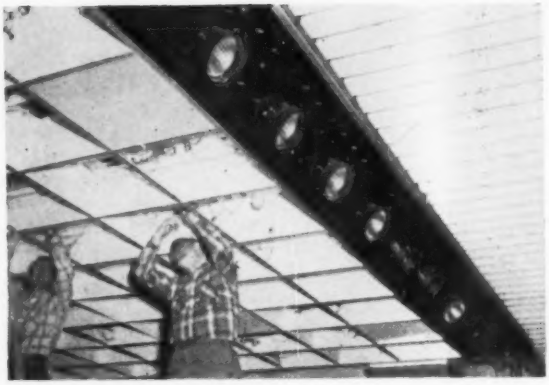
. . . includes lighting intensities as high as 450 footcandles, dimmer control, low-noise-level transformers, innovations in local power distribution and comprehensive grounding system.

By Hugh P. Scott

A $17-MILLION 24-floor shaft of aluminum and glass—first new skyscraper to alter Cleveland's skyline in nearly three decades—features top-flight lighting, year-round climate control, high speed automatic elevator service and unusual flexibility for transforming and distributing multi-voltage power to serve modern commercial requirements.

Rising to a height of 300 ft, the rectangular structure has a functional center core where all building services are concentrated. This provides completely unobstructed peripheral floor space where daylight can augment artificial illumination; where possibilities for arranging office facilities are unlimited, and where sealed windows (cleaned from exterior electric travelling "stages") exclude dust, dirt and smoke from the building's interior. Moreover, all space is con-

LOW VOLTAGE RELAYS with 24-volt dc coils operate 277-volt fluorescent and 120-volt incandescent lighting installed above luminous ceiling in auditorium. Control is possible from either of two switching and dimming consoles recessed into theatre wall panels.

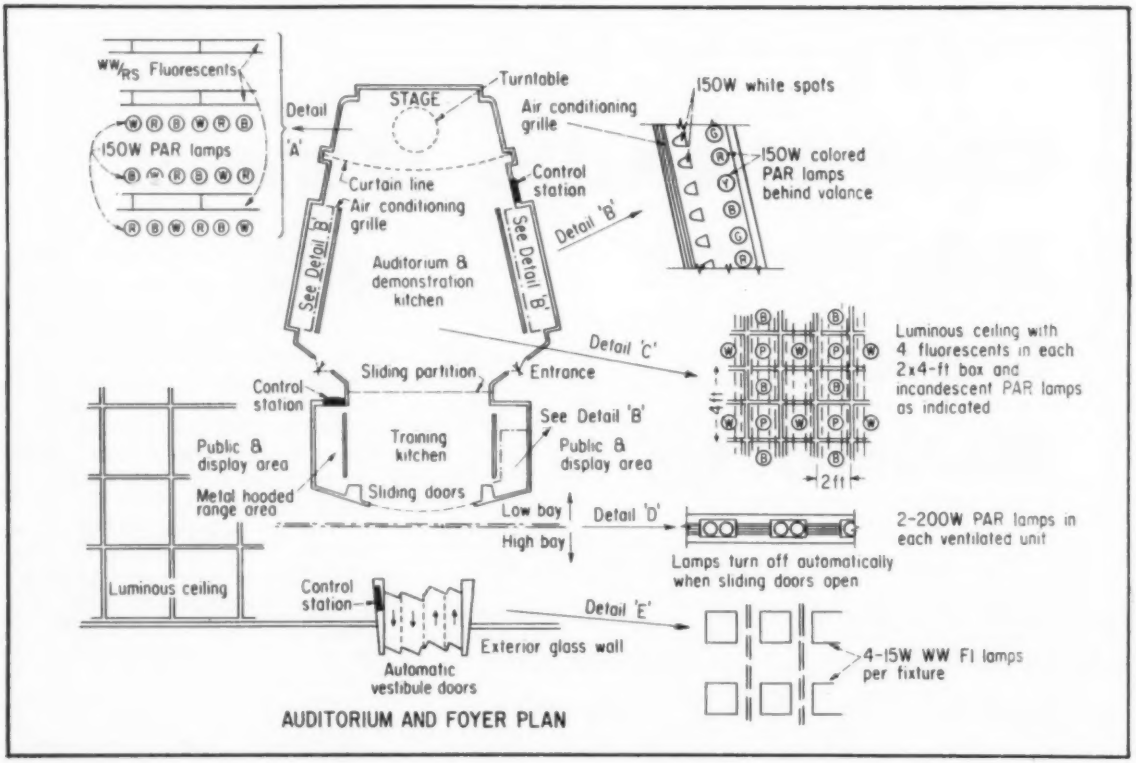


SERIES OF BOXED FIXTURES (left), equipped with Honeylite cellular bottom panels, contain both white fluorescent and colored incandescent lamps. All boxes and lighting components are separately circuited and dimmer-controlled to permit variations of pattern, tonal values and intensity.

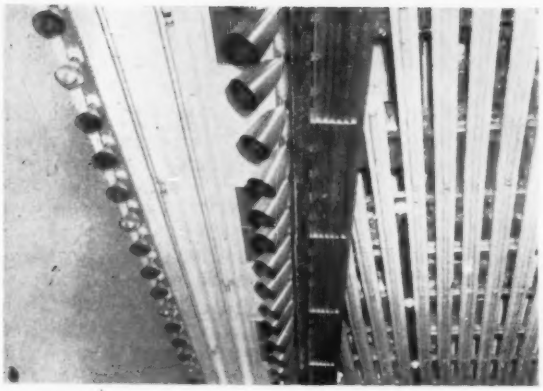
ditioned by filtered, humidified and temperature-balanced air provided by a central 2000-ton multi-zone cooling installation.

In this modern building, lighting is excellent both in quality and intensity; one of several illumination highlights being found in a first-floor auditorium which can be used either as a 120-seat theatre or as a combination demonstration-training kitchen area.

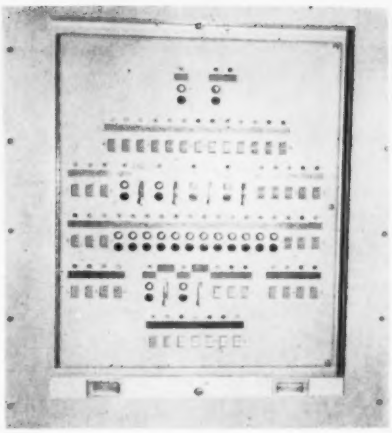
As indicated by the drawing directly below, a 14-ft-deep stepped-stage contains a 9-ft turntable and extensive multi-voltage receptacle facilities. It is illuminated by four continuous rows of fluorescent fixtures plus three additional rows of 150-watt PAR lamps on 6-in. centers. Strip fluorescents are warm white in color and operate at 120 volts. Incandescent spots are alternately red, blue and white;



AUDITORIUM and demonstration kitchens are lighted by wide variety of mediums; a few of which are indicated by the detail sketches showing (a) section of typical lighting above stage, (b) spot- and flood-lighting above side alcoves, (c) luminous ceiling panels combining incandescent with fluorescent sources, (d) line of alternate PAR lamps and ventilating units in lobby, and (e) square luminous fixtures above vestibule entrance.



ALCOVES along sidewalls of demonstration kitchen (separated from main auditorium area by air-conditioning grille) are top-lighted by valance-shielded colored PAR lamps, adjustable white spotlight units, and recessed fluorescent strips. Power for demonstrations is provided by variety of receptacles.



CONTROL of lighting in theatre is from either of two wall-recessed consoles containing remote-control switches and pushbuttons, illuminated nameplates and pilot lights, magnetic controllers and dimming potentiometers. Steel shutters may be rolled up from bottom and locked when consoles are not in use.

are dimmer controlled and operate at 120 volts. All stage lighting is mounted overhead in recessed ceiling troughs, and each color is separately circuited to permit tonal control.

Over both the demonstration and training areas a suspended luminous ceiling (consisting of etched Honeylite panels that provide 60-degree shielding) is supported by an aluminum T-bar grid. This ceiling is hung beneath an installation of 96 special 2- by 4-ft 11-in. deep boxes; each box containing four RS fluorescent lamps on 6-in. centers. Related ballasts are single-lamp fused dimmer-type units, providing 277 volts for lamp operation and controlled through relays with 24-volt dc coils. In addition, 50 of the boxes also contain two 150-watt PAR lamps each (pink and blue-white), while the remaining 40 boxes contain single white incandescent spots. These spotlights are likewise dimmer controlled so that lighting patterns may be varied by color and intensity as well as by boxed modules.

Wall alcoves in both of these main areas are additionally top-lighted by ceiling-recessed WWX/RS fluorescent strips, adjustable incandescent white spots, valance-shielded colored PAR-38 down-lights, and (over ranges) vapor-tight fluorescent and incandescent fixtures.

Low-Voltage Dimmer Control

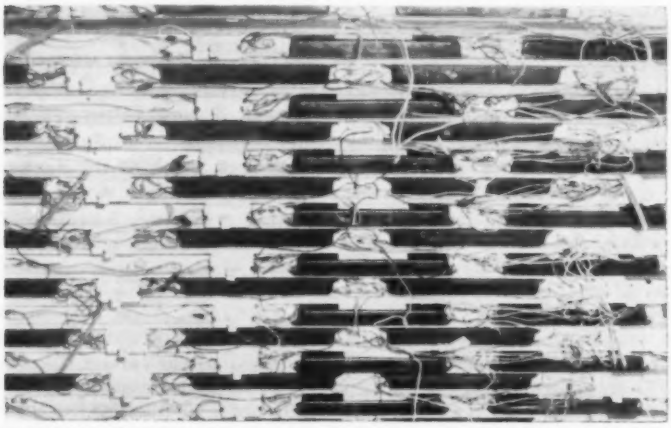
Lighting control is from either of two wall-recessed consoles; these containing pushbuttons and remote control switches, pilot lights and back-lighted illuminated nameplates, potentiometers and magnetic contactors.

Dimming of theatre lighting is by means of eight motor-operated transformer-type non-interlocking dimmer equipments with 11 auxiliary units and five potentiometer controllers. Dimmer motor drives, operating on 24-volt dc, are designed to vary lighting intensities from off to full-brightness in an interval of 14 seconds. Related relays, timers, rectifiers and special boost-and-buck single-phase 120/32-volt transformers are contained in free-standing panels located outside the theatre proper, based in wall niches in an adjacent corridor of the building.

Since (in addition to stage facilities) all walls of the theatre are liberally equipped with close-spaced multi-voltage receptacles; since open floor areas of the demonstration and training kitchens are additionally equipped with underfloor ducts, and since all receptacle circuits are separately controlled (from four corridor-located panels), unusual scope and flexibility is provided for presenting an almost-unlimited variety of demonstrations and displays in this well equipped and illuminated theatre.

LUMINOUS CEILING over demonstration kitchen consists of Honeylite panels suspended beneath series of box fixtures; each box containing four fluorescent lamps and either one or two white or colored PAR lamps. All light sources are dimmer controlled and separately circuited to permit wide variety of illumination patterns involving color and intensity.

CONTINUOUS ROWS of 40-watt RS fluorescent lamps are installed on 2½-in. centers in 500-sq-ft office of CEI president to provide intensities up to 450 footcandles. Installation represents light-load of 50-w/sf . . .



SINGLE-LAMP BALLASTS, individually fused, are controlled from either of two auto-transformer low-voltage dimmer panels in office. Illumination level can range from "off" to full-brightness in 14 seconds . . .

ALUMINUM T-BAR FRAMEWORK, accurately levelled during installation, supports plexiglass diffusing panels and maple wood-louver shielding grid. Flanges of T-bars are felt-covered to cushion diffusing panels held thereon.

Luminous Ceiling for Display

Surrounding the theatre on three sides is a luminous-ceilinged public and display area, the ceiling consisting of ¼-in. plexiglass panels mounted in an inverted T-bar aluminum grid. T-bar flanges have white felt strips cemented to them to cradle the panels; bars are suspended independently of overhead lamp channels, while diffusing panels are self-extinguishing in event of combustion, and are destaticized to repel dust from collecting on surfaces. Lamps mounted above this ceiling are variously 6-ft and 8-ft instant-start slimlines, plus 40-watt RS fluorescents. Lamps are mounted continuously end-to-end with row-to-row distances of 6 ins.

Bordering this luminous display area (and separating it from a high-bay section existing immediately inside the 2-floor all-glass lobby front) is a continuous row of alternately-placed floodlight units and air-conditioning grilles. Floodlights are 200-watt PAR-46 side-prong lamps, mounted in 12-in. deep ventilated boxes; each lamp being individually adjustable over a 40-degree vertical and 180-degree horizontal angle. Floodlight units mounted directly above the rear sliding entrance to the theatre are activated by door switches so that they may be turned off automatically whenever the curved doors are opened.

Intensities as High as 450-FC

Another lighting installation meriting commendation is the office of CEI's president, where 485 rapid-start 40-watt white fluorescent lamps are mounted in continuous rows on 2½-in. centers above a luminous plexiglass suspended ceiling to provide illumination levels up to 450-fc maintained in this 500-sq-ft area. Representing one of the nation's first non-experimental commercial installations to provide lighting intensities of this order at desk level, this single 22-ft square room has a total lighting load of 25-kw, i.e., a load density of 50 w/sf. Lamps are divided into seven 277-volt 30-amp circuits; are held by locking sockets and are equipped with fused dimming-type single-lamp ballasts.

Special designing is evidenced both in lamp-mounting and ceiling-suspension; the former dictated by the extreme closeness of the row-

PRIVATE OFFICE of CEI's president is illuminated by 485 rapid-start white fluorescent lamps mounted continuously, with rows on 2½-in. centers, above plexiglass suspended ceiling and waffle louver grid. Lighting load density is 50-w/sf and maximum intensity is 450 fc.

ENGINEERING DEPARTMENT is typical of open-area office space where luminous ceiling treatment provides general diffused lighting in the order of 100-fc or better. Minimum design standards considered 10-w/sf for lighting, with air-conditioning and receptacle loads added to this basic figure.

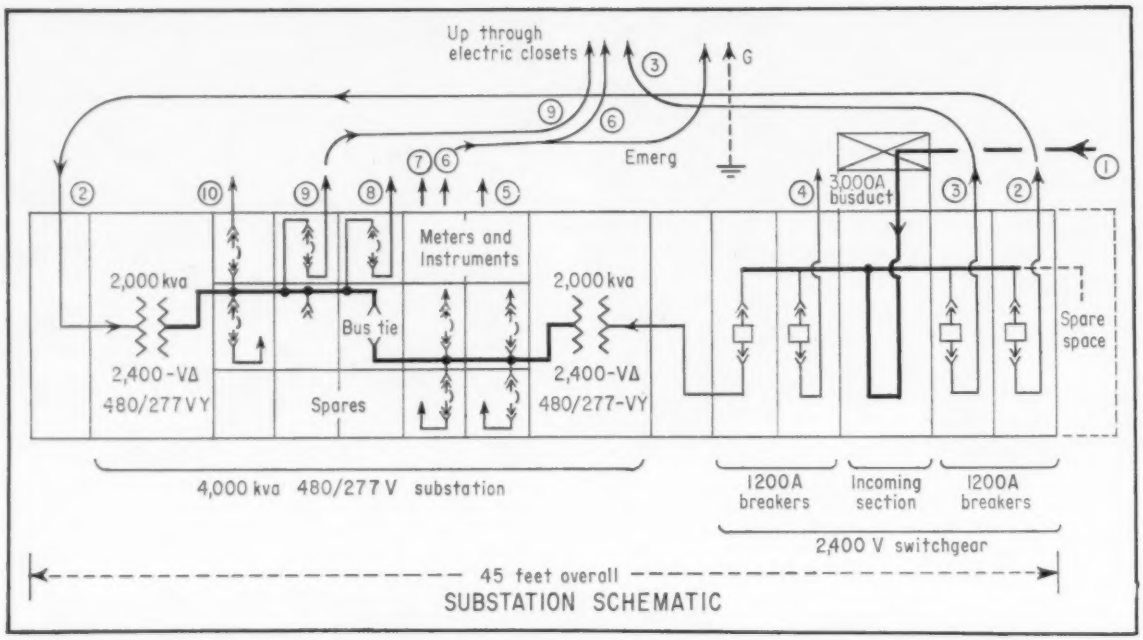
RECESSED CONCAVE circular plexiglass diffusing plates, plus triple-row fluorescent perimeter troffers provide visual interest as well as functional illumination to table and wall areas in this Board Room where dimmer-controlled intensities have a maximum of 200 fc.

CUSTOMER CONTACT area in utility-company section of building consists of 8 booths which are lighted by transilluminated partitions and end-wall panels as well as by thin (less than 3-in.) surface-mounted 4-lamp fixtures centered in each alcove.

to-row lamp pattern, and the latter due to the fact that the aluminum T-bar grid that supports the luminous panels likewise supports (from the top) a waffle baffle system consisting of 6-in.-deep maple louvers. Like the ceiling of the first-floor theatre, T-bar flanges are felt-covered to cushion the translucent white panels, while the grid is suspended completely independently, i.e., not connected to wiring channels or the framing for same.

Dimming of lamps can be controlled from either of two stations; each station consisting of a low-voltage dial-graduated potentiometer and a momentary-contact push-button that permits shifting of dimming control from one station to the other, as desired. Dimming equipment consists of two auto-transformer panels that collectively combine seven auxiliary non-interlocking units (one for each of the seven circuits); dimming motor drives designed to activate lights from off to full brightness in 14 seconds, and double-coil relays are used for potentiometer selection. Dimmer controls are equipped with limit switches at their low ends of travel to operate magnetic contactors opening the 277-volt circuits.

This same general type of illumination (luminous panels with cir-



2400-VOLT SWITCHGEAR and double-end 4000-kva 480/277-volt substation are installed as a continuous unit adjacent to exterior wall which separates this basement vault from underground utility feeder and transformer station. This arrangement permits segregation of voltage levels while minimizing connection distances between related equipment. Risers going up through building include 2400-volt armored-cable feeders for 23rd-floor substation (3), 480/277-volt aluminum busduct for floor closets (9), 120/208-volt emergency service (6) and vertical ground cable (G).

cuiting at 277 volts and with lamps individually fused and ballasted) is used in other executive offices and secretarial areas also, although luminous panel patterns vary in texture and support details, rows of lamps vary in their center-to-center distances to provide intensities that vary from 200- to 100-fc, and methods of control vary to provide either selective 3-step lighting or to operate lamps on a conventional on-off basis.

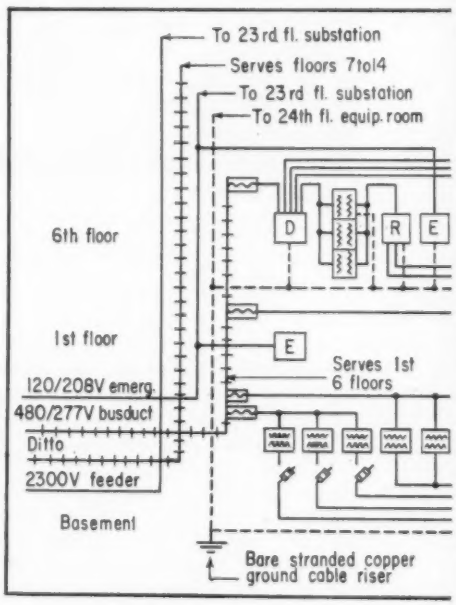
Special areas (such as the Board Room, elevator lobby and reception room) utilize circular recessed concave plexiglass diffusers, plus triple-row fluorescent perimeter troffers or coves. Some of these areas also have dimming facilities; operate at 120-volt as well as at 277-volt and (in the dining room) use colored enameled panels in random placements to inject elements of visual interest.

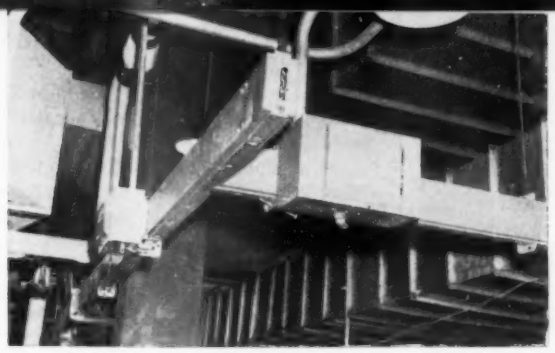
General office areas on floors 2 through 6 are lighted to levels in excess of 100-fc while above the 6th floor the minimum general lighting *standard* is 50-fc although, again, this minimum standard is consistently exceeded. In design, a value of 10 w/sf was taken to size lighting circuiting, control equipment and feeders for these upper floors, although this average sq-ft factor is considerably higher when receptacle and air conditioning requirements are also considered.

As to electrical distribution, voltage cascades from an initial 11-kv to 2300 volts in an underground utility vault; drops again to 480/277 volts for general power and fluorescent lighting utilization in two substations (a double-end 4000-kva unit in the basement and a 1500-kva sub on the 23rd floor), then is transformed to 120/208 3-phase 4-wire, 120/240-volt single phase, or to 240-volt 3-phase 3-wire service via miscellaneous transformers as required for local low-voltage service.

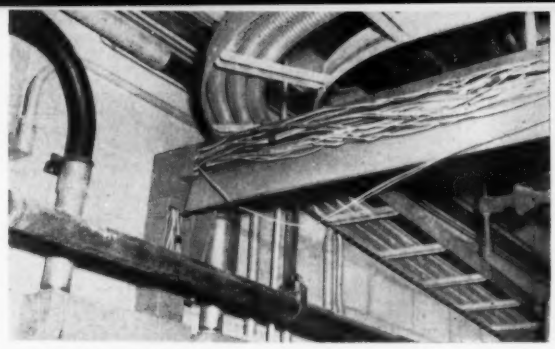
In this sequencing, the 11-kv 3-phase network power is first delivered to the utility vault through two separate feeders terminating in an automatic transfer switch. After initial transformation to 2300 volts, it is carried through an end-cable tap and 3000-amp power busduct directly to an enclosed dead-front factory-coordinated metalclad switchgear assembly (indicated by Feeder No. 1 in the "Substation Schematic" shown above). This primary (2300-volt) bus structure consists of four 4-by ¼-in. copper bars per phase, although all subsequent secondary (480/277-volt) busduct feeders in the building are of aluminum.

All 2400-volt switchgear is installed adjacent to the double-end basement substation, being electri-





ALUMINUM PLUG-IN BUSDUCT distributes 480-volt 3-phase power through basement to various motor and distribution centers, while low-reactance busducts carry 480/277-volt 4-wire power up through building to successive electric closets . . .



INTERLOCKED ARMORED CABLE, supported overhead by ladder racks and clamped to same at 3-ft intervals, is used to carry 2400-volt power to compressor and blower motors as well as to 23rd-floor substation. Square wireway contains local low-voltage wiring.

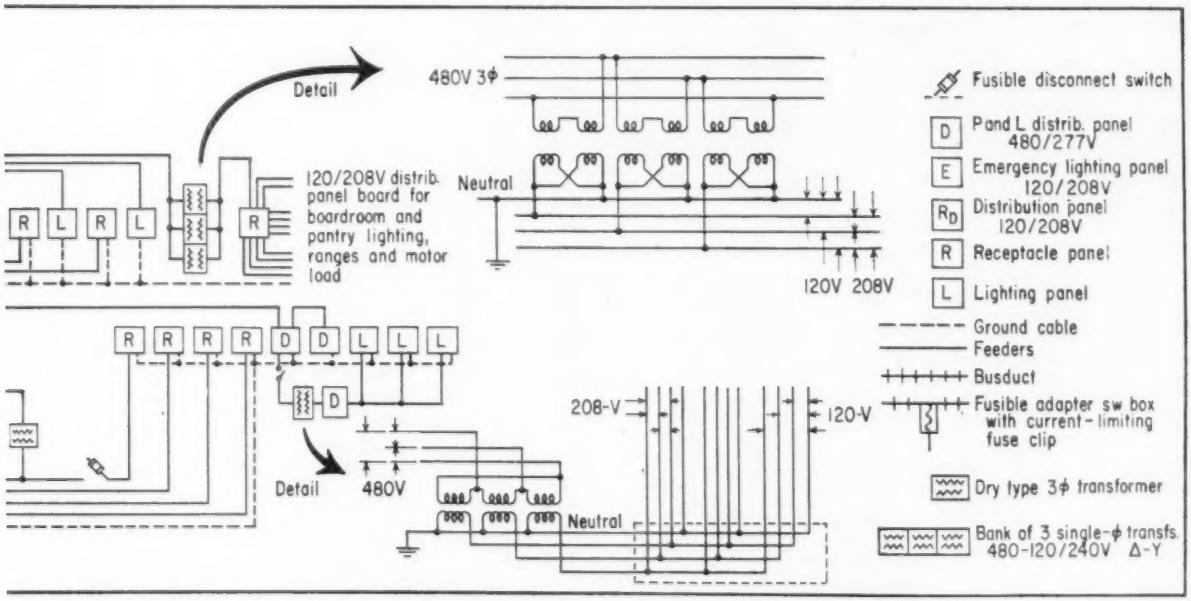
cally connected to the two 2000-kva dry-type transformers of that substation through separate 1200-amp breakers, an internal section of bus and an external run of interlocked armored 5-kv cable supported overhead by means of aluminum ladder racks (designated as Feeder 2 in the already-mentioned sketch).

Interlocked armored cable on aluminum racks is likewise used as the distribution medium between the 2400-volt switchgear and the 23rd-floor substation (feeder 3), and it is also used to serve several large 2400-volt compressor and blower motors (ranging from 600- to 150-hp) located in the basement (feeder 4). Armored cables are clamped to racks at 3-ft intervals, while racks are supported or suspended by bars or brackets on 6-ft centers.

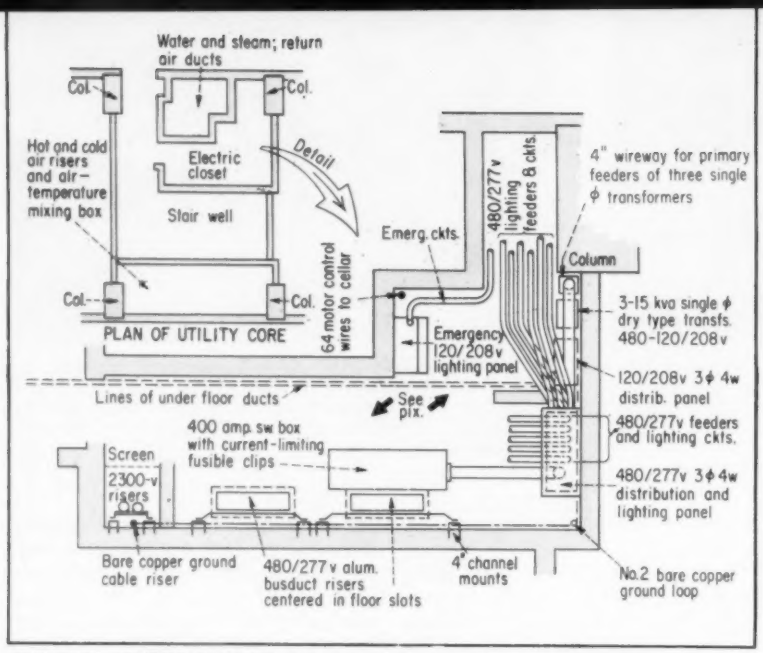
In the 480/277-volt substation section, five banks of ACB switching cubicles are inserted between the twin transformers; the middle cubicle containing a bus tie between the two delta-wye transformers, while the other cubicles contain either secondary drawout breakers, related instruments and meters, or space provisions for additional equipment as required. Breakers with the same ratings are interchangeable; removable elements can be padlocked either in their connected or test positions without interfering with their normal operation; primary disconnects are silver-to-silver pressure contacts with stationary elements porcelain-insulated from cubicle framework, and automatic safety shutters are provided to close entrances to primary disconnects whenever breakers are lowered for testing or withdrawal.

Since the 2-room utility vault is located outside of, but immediately adjacent to, the exterior wall of the 2400-volt switching and main 480/277-volt substation vault, complete segregation is obtained between high-voltage switchgear, primary transformers and all building-owned equipment, although, at the same time, the connection distances between transformers and breaker compartments are reduced to absolute minimums.

The building's second 2400-480/277-volt substation, located on the



ABBREVIATED RISER DIAGRAM shows 2300-, 480/277- and 120/208-volt risers; typical method used for tapping busducts via fusible adapters; arrangement of single-phase and 3-phase transformers; panel arrangements and grounding facilities.


Water and steam; return air ducts
Col.
Col.
Hot and cold air risers and air-temperature mixing box
Electric closet
Detail
Stair wall
Col.
Col.
PLAN OF UTILITY CORE
64 motor control wires to cellar
Emerg. ckts.
480/277v lighting feeders 8 ckts.
4" wireway for primary feeders of three single ϕ transformers
Column
3-15 kva single ϕ dry type transfs. 480-120/208v
Emergency 120/208v lighting panel
120/208v 3ϕ 4w distrib. panel
Lines of under floor ducts
See plx.
480/277v feeders and lighting ckts.
400 amp. sw box with current-limiting fusible clips
Screen
2300-v risers
480/277v 3ϕ 4w distribution and lighting panel
Bare copper ground cable riser
480/277 v alum. busduct risers centered in floor slots
4" channel mounts
No.2 bare copper ground loop

ELECTRIC CLOSET DETAILS indicate relative positioning and mounting arrangement of busduct risers and feeder taps, grounding loop, normal and emergency power distribution panels, local transformers, underfloor duct connections and conduit for local circuitry.

BUSDUCT RISERS serving electric closets, with their bars interleaved to minimize reactance, are contained in perforated steel enclosures equipped with removable access sections. Ducts are supported by channel brackets recessed into walls just above slots in the successive floor-slabs.

OVERHEAD CONDUITS and liberally-sized pullboxes are related to 480/277-volt lighting and feeder circuits, while square wireway contains primary feeders serving bank-of-three single-phase 480-120/208-volt dry-type transformers. All equipment is grounded to No. 2 bare stranded copper loop.

23rd floor, is a complete radial load-center dry-type unit having a normal self-cooled rating for 1500-kva and a forced-air potential for 2000-kva (obtainable by installing automatically-controlled single-phase fans at a future date, if so required). Should load growth demand even more than this fan-cooled potential, spare space provisions would permit a 300-kva extension to the present installation. This load-growth possibility is likewise insured through the existence of already-installed oversized feeders (from the basement-based 2400-volt switchgear) and a 300-amp electrically-operated main drawout circuit breaker.

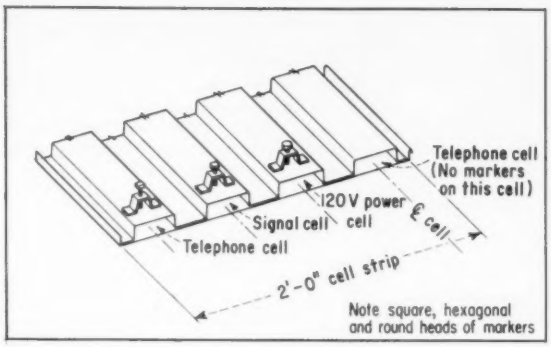
On all floors from the first to the 23rd, electric closets are tierred vertically, all risers passing upwards through these local distribution points so that main breakers and distribution panels in each closet can be connected to risers either directly or by minimum-length connections.

As indicated by the accompanying "Abbreviated Riser Diagram" and "Electric Closet Details", 480/277-volt power is carried to closets by three vertical busduct runs; a 2500-amp riser (from the basement-based substation) serving floors 1 through 6; a second 2000-amp ditto serving floors 7 to 14 inclusive, and a third 2000-amp busduct (*descending* from the 23rd-floor substation) serving the remaining part of the building from the 15th floor to the roof.

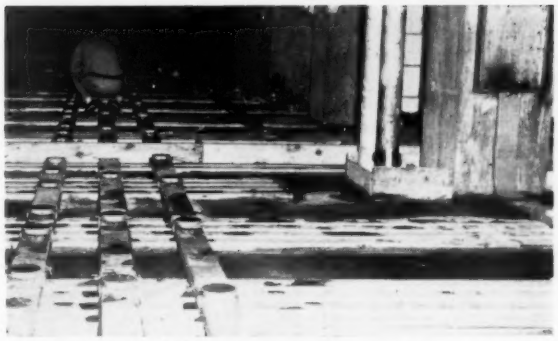
These busducts consist of multiple 2- by ¼-in. aluminum bars, individually insulated, interleaved to minimize reactance, and installed in multiples sufficient to restrict line-to-line voltage-drop to 3 volts per 100 ft under least-favorable conditions. Neutrals are half-phase sized; all bus joints are silver plated; buses are carried in perforated steel enclosures with removable cover sections; ducts pierce successive floor slabs through vertically-aligned 24- by 6½-in. slots, and enclosures are supported at each floor level by wall-embedded channel brackets.

Individual floor loads vary from 200- to 600-amps; these power requirements being provided through 480/277-volt busduct feeder taps consisting of fusible switch adapters having current-limiting fuse clips. Each switch box is mounted directly adjacent to the busduct riser serving same, and switches are manually-operated units rated for 50,000-amp interrupting capacities.

Some 120/208-volt 3-phase 4-wire power is locally provided by banks of three single-phase dry-type transformers which are wall-mounted in each electric closet, although on most tenant floors single-phase 120/240-volt 3-wire power is provided. Capacities of individual transformers range from 5- to 25-kva; they have maximum noise-level ratings below 46 decibels, and each bank of three units is connected to ground on the secondary



MODIFICATION of cellular floor stripping is used on first six floors of building, where multiplicity of floor outlets is greater than normal. Note distinctive shapes of marker screwheads used to identify cells.



CELLULAR SECTIONS, containing four cells in each 2-ft width, are laid directly on underslabs, then are levelled, grouted, anchored and equipped with junction boxes and necessary header ducts.

side (as indicated by the "Riser Diagram" Detail) to provide the desired current characteristics. Each tenant is served through separate transformers, due to the tenant metering being on the 480/277-volt service.

It will also be noted in the diagrams that each closet obtains *emergency* 120/208-volt (single-phase) power from one of two feeders rising from a dry-type 112½-kva delta-wye basement-based transformer. Such emergency power provides for the operation of panic lighting in stairwells, corridors, elevator lobbies and at all exits.

All electrical equipment in closets is grounded to bare stranded 2-gage copper loops which, in turn, are tapped to a 2/0 vertical ground cable rising from a group of three copperweld ground rods buried directly beneath the tier of closets. This grounding point is but one of several such installations wherein three 10-ft rods are ground-driven 7 ft on centers in a triangular pattern, then are tied together by bare tinned stranded cable secured to rods by cadwelding. Ends of rod-connecting ground cables are then brought up through the building's base slab, are clamped to structural reinforcing bars at numerous points, and terminate at steel column base plates via additional cadwelded connections.

In considering distribution of 120 volts, telephone and signalling wiring throughout tenant premises, it is of interest to note that two distinct types of underfloor duct systems are used; a conventional 2-duct peripheral installation being used from the 7th floor upwards, and a modification of cellular floor stripping being used from the 6th floor downwards (where requirements for distribution flexibility and multiplicity of outlets is considerably above the norm).

On upper floors, ducts are supported by standard saddles; are end-capped by closure blanks, and utilize 3-in. deep individual JBs equipped with 1½-in. extension rings and recessed-type top covers.

Cellular strips on low floors (see diagram) contain four cells in each 2-ft width. These strips are laid directly on rough concrete floor slabs; are levelled, grouted and anchored by means of powder-driven studs; are appropriately equipped with junction boxes, header ducts, ells and panel connections; and are identified by variously-shaped cell markers: square heads designating telephone cells, hex-heads marking signal channels and round bolt heads locating 120-volt power cells. Since outlets may be installed by the simple expedient of boring holes in the proper cells, pulling in necessary wires and placing receptacles in position; and since close-spaced cells provide extensive blanket coverage of floor areas so designed, the six floors using this method for low-voltage distribution offer almost unlimited flexibility for desk and office equipment layout.

Because of the building's construction (reinforced concrete without a steel frame) the normal procedure of spot-welding the cellular strips to the structural steel could not be followed, so the above-described innovation was developed for this specific installation.

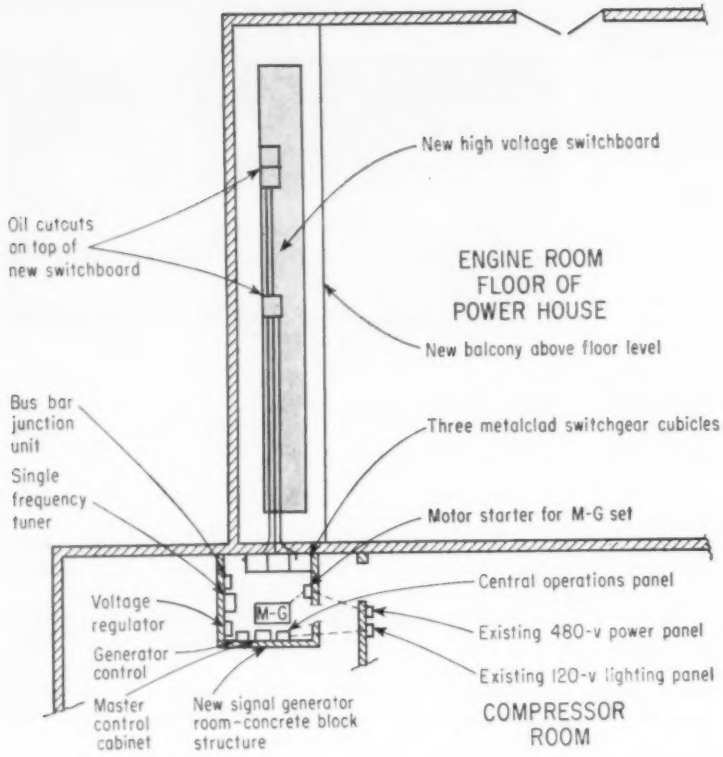
Due to the extent of artificial illumination in the building, plus a sizable "sun load" contributed by the large glass wall areas, both heat-gain and related air-conditioning requirements are high.

To take care of these requirements two hermetic centrifugal cooling units (rated at 1200- and 500-hp and capable of delivering 2000 tons of cooling) are installed in the basement; two primary air-handling units at that same location serving the lower 11 floors, and two additional penthouse-based units taking care of the upper half.

Cooling requirements are further subdivided into center-core and peripheral-spaced zones; with a high-pressure conduit induction system serving the perimeter, and low-pressure single-duct distribution serving interior areas where weather variations are less evident and where lighting, business-machine and electrical-appliance loads are relatively stable.

Chilled water for the entire system is provided by fans and cooling coils of the basement- and penthouse-based units, while individual control of peripheral zones is possible through the installation of approximately 1500 vertical-type induction air-handling units positioned beneath exterior windows. These individual units are predominantly furred-in to blend with the decor of the interior. And, collectively, they provide a total of about 144,000-cfm of cooled air.

Responsible for the electrical installation in this modern office building was the architectural firm of Carson & Lundin, New York City; consulting engineers McGeorge-Hargett and Associates of Cleveland; associate consultants Jaros, Baum & Bolles, New York, and the Harrington Electric Company, Cleveland.



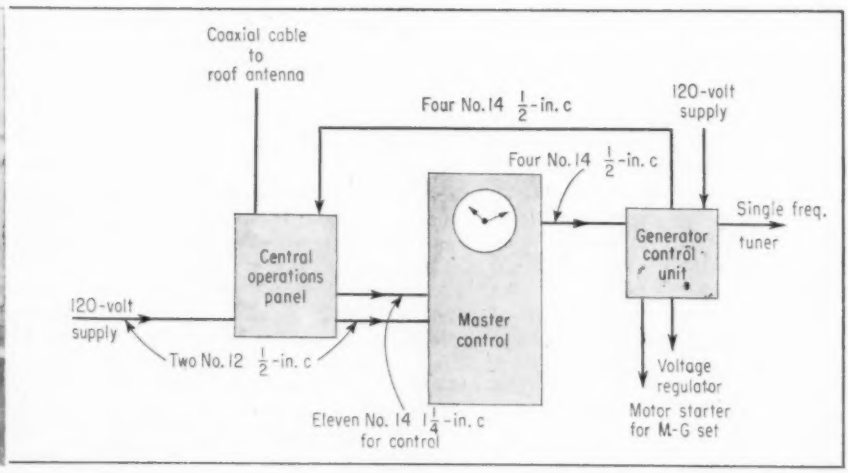
BASIC PLAN shows layout of equipment in the academy power house and in the signal generator room where the control system devices are installed and supplied from existing panelboards.

WIRING DIAGRAM of control units (right) shows the extent of conduit and wire circuiting in the signal generator room and out to the main switchboard bus. Each switchgear cubicle is arranged with a 400-amp load break switch fused at 50 amps and connected to provide disconnect and protection for the capacitors as load devices on a 4160-volt circuit. Section 4607 of the National Electrical Code sets the requirements for capacitor circuits, although the application here differs from normal application.

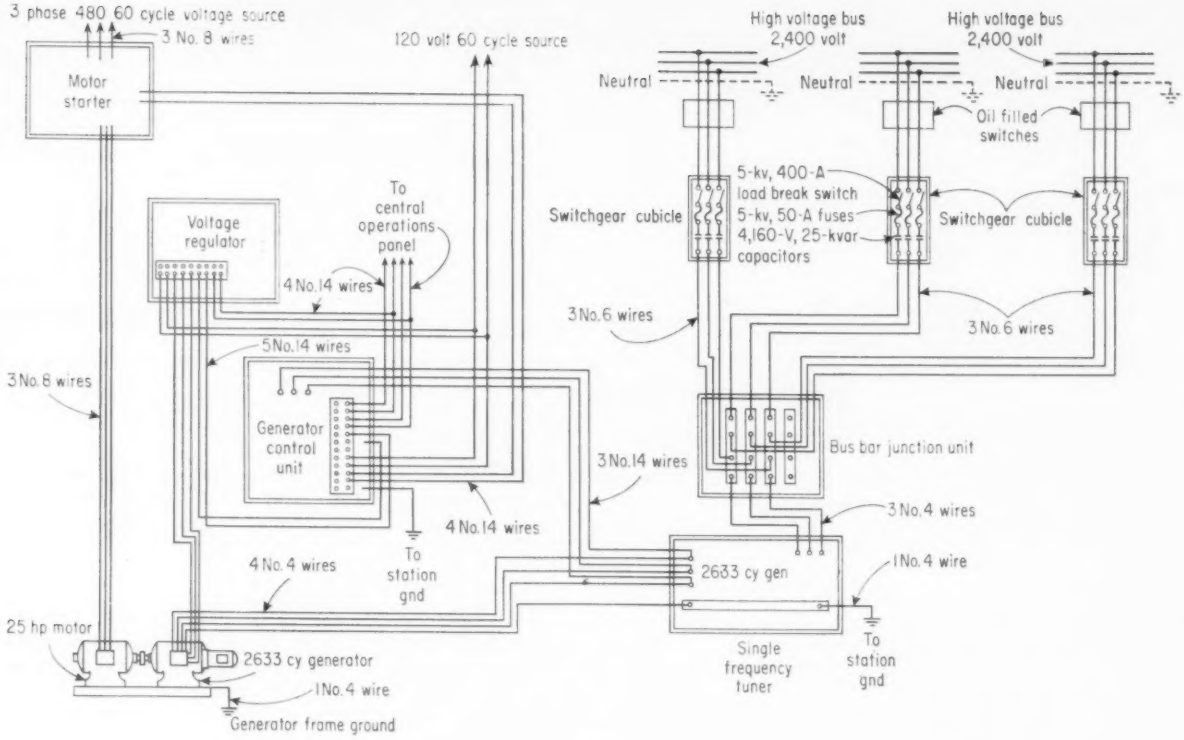
At West Point, B-B Electrical Contractors installed . . .

Carrier Frequency

A case study in the electrical construction and installation of a modern, radio input, carrier frequency control system which supervises all of the clocks throughout the U. S. Military Academy, West Point, N. Y.



CONTROL EQUIPMENT on one wall of signal generator room is shown in the diagram at right and in the photo at left. The rotary frequency converter is shown in the photo.



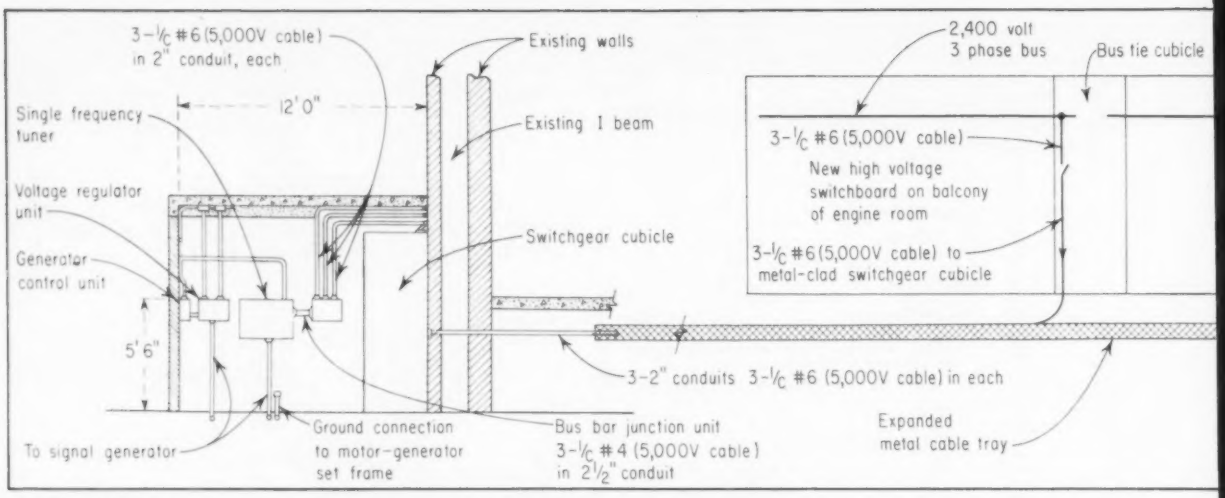
Clock Control

AS PART of extensive electrical modernization at the U. S. Military Academy, B-B Electrical Contractors, Paterson, N. J., installed a complete carrier frequency control system to control 332 clocks. This installation was made as part of the electrical contract, and construction included not only the straight electrical work, but even a concrete-block room to house the system equipment.

Basically, the system here provides automatic synchronization of all clocks with radio signals of time broadcast by the National Bureau of Standards. The synchronizing signals trigger high frequency pulses from a signal generator which is tied into the main switchboard of the general power and light distribution system. Capacitors are used to tie the signal generator to the high voltage main switchboard. The capacitors, because their impedance varies inversely with frequency, connect the signal generator to the switchboard at high frequency but isolate it from the switchboard at 60 cycles. The synchronizing pulses are transmitted along feeders, through step-down power transformers and right out to the 120-volt, ac clock branch circuits. The same wires which power each clock motor bring the signal pulse to it.

A special whip antenna is mounted on the roof of the Academy's power house and is equipped with a lightning arrester, grounded to building steel. A coaxial cable from the antenna is brought down and into the clock control room which adjoins the main high-voltage switchboard in the power house. The antenna lead is connected to a radio receiver which is mounted in a master time control center and is tuned to station WWV of the NB of S. This receiver is a single-channel, crystal controlled, 5-tube superheterodyne type. A 600-cycle audio filter and rectifier in the receiver separates the synchronizing signal which

CONSTRUCTION DETAILS of this control system installation are shown here for the single-frequency tuner (shown with cover removed) and the bus bar junction unit at right. These are mounted on wall of signal generator room. Copper bus grounding network is shown at bottom. One No. 4 TW conductor is shown coming from ¾-in. conduit, connecting to ground bus frame of M-G set.

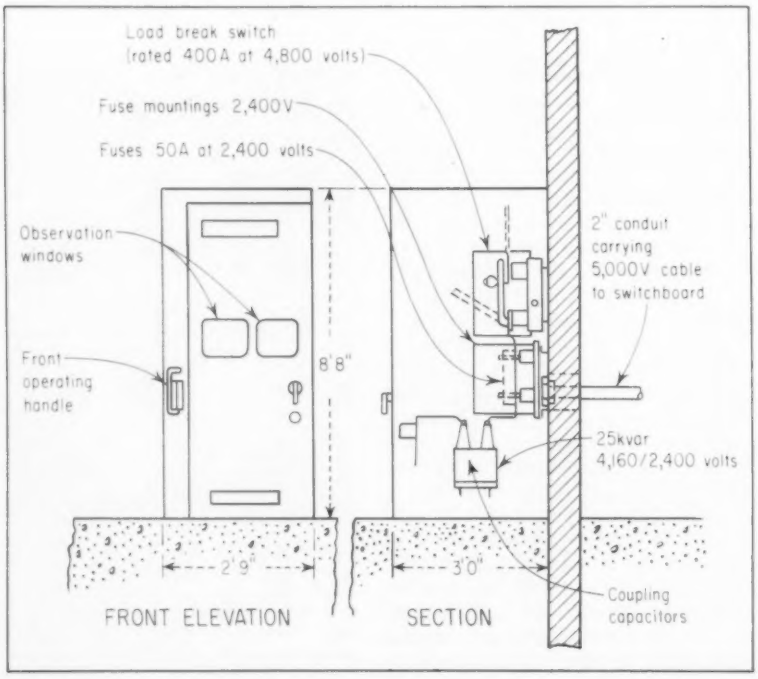

3-1/c #6 (5,000V cable) in 2" conduit, each
Existing walls
2,400 volt 3 phase bus
Bus tie cubicle
Single frequency tuner
12'0"
Existing I beam
3-1/c #6 (5,000V cable)
New high voltage switchboard on balcony of engine room
Voltage regulator unit
Switchgear cubicle
Generator control unit
3-1/c #6 (5,000V cable) to metal-clad switchgear cubicle
5'6"
3-2" conduits 3-1/c #6 (5,000V cable) in each
To signal generator
Ground connection to motor-generator set frame
Bus bar junction unit 3-1/c #4 (5,000V cable) in 2 1/2" conduit
Expanded metal cable tray

FEEDER SCHEME for connecting high frequency feeders from switchgear in signal generator room to three sections of main bus in switchboards is shown in this diagram. The oil-filled cutouts in the 5000-volt cables provide disconnect and short-circuit protection for the cable runs to the switchgear in the signal generator room.

actuates the clock correcting mechanism. The master time control automatically seeks the WWV signal once each hour. If the signal is not obtained due to atmospheric conditions, electrical radiation or other disturbances, the control device will continue to seek the signal every ten minutes until a comparison time is effected and correction is made.

The master control center is a vertical wood cabinet with a plate glass door and is equipped with a 10-in. clock with a sweep second hand. It is supplied by a single 20-amp, 120-volt circuit which also powers the adjacent central operations panel.

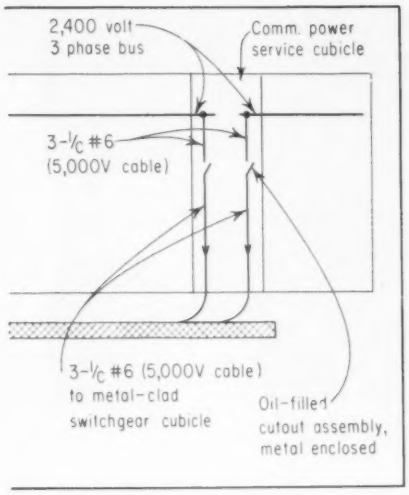
Although not in use at present, a special central operations panel has been installed as part of the overall electronic control system here. The central operations panel is a control panel through which the high-frequency pulses are delivered to the power and light distribution system. This panel provides programmed and manually selected ON-OFF switching operations by means of electronic receivers and coded relays which respond to command pulses. The pulses are transmitted over the regular distribution circuits and are picked up by the receivers and relays which provide, in effect, remote wireless operation of contactors, motor starters and other relays. The panel is equipped with a wide range of program control circuits—toggle switches, indicating pilot lights, rotary switch, etc. This panel can be easily programmed for any system of remote switching throughout the electrical distribution system.

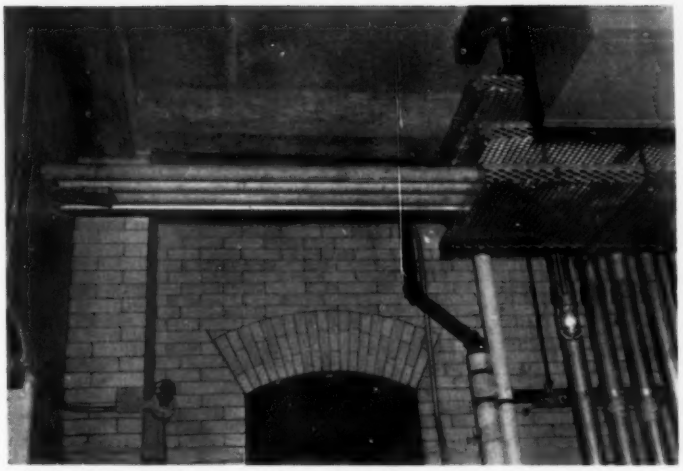


HI-VOLTAGE SWITCHGEAR cubicle is used for each of the feeders which tie the rotary signal generator into the bus sections in the main 4160/2400-volt switchboard. These cubicles are installed alongside each other in the signal generator room.

Accompanying photos and diagrams illustrate details of this type of electrical installation. The actual installation can be divided into two separate parts: (1) the installation of the control room layout, and (2) the installation of the clocks themselves.

The installation of the control room and the connection into the main switchboard involved standard wiring methods for power distribution and some special techniques peculiar to this job. A motor-generator unit was set on a slab and connected for supply and output. This M-G furnishes the high frequency signal for synchro-





CONDUIT FEEDERS carrying No. 6 5000-volt cables come through wall at left from signal generator room and terminate in cable tray, which supports cable runs to the points at which they rise through balcony.

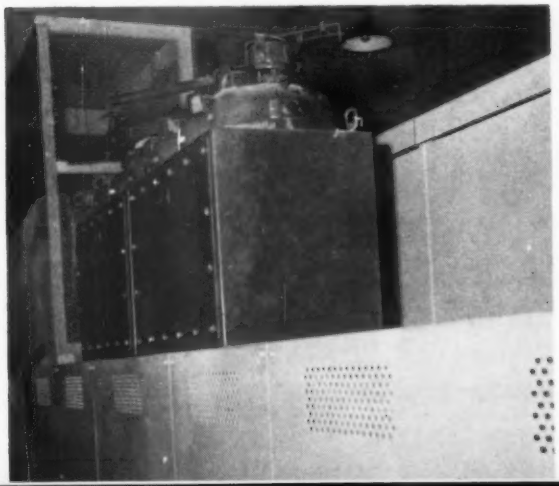
nizing the clocks. This same signal also will be used for any carrier frequency switching operations which will be installed at a later date. The output signal from the M-G set is carried through associated control devices into an adjacent high voltage switchgear which houses the coupling capacitors, fuse protection for the capacitors, and a load break disconnect switch. From this switchgear, the signal passes over cables in conduit to the bus bars of the high voltage switchboard.

Power supply for operation of this control system is derived from two existing panelboards near the signal generator room. One panelboard is a 3-phase, 4-wire, 120/208-volt board from which three 120-volt circuits are derived through three spare 20-amp CB's. One of these circuits supplies the lighting fixture and a duplex grounding type receptacle in the generator room. A second circuit supplies the voltage regulator unit and generator control unit. The third circuit supplies the master control and the central operations panel. These circuits are run as a single multi-wire branch circuit of 3-phase conductors and a common neutral. The home run consists of four No. 12's in a $\frac{3}{4}$-in. conduit in the floor.

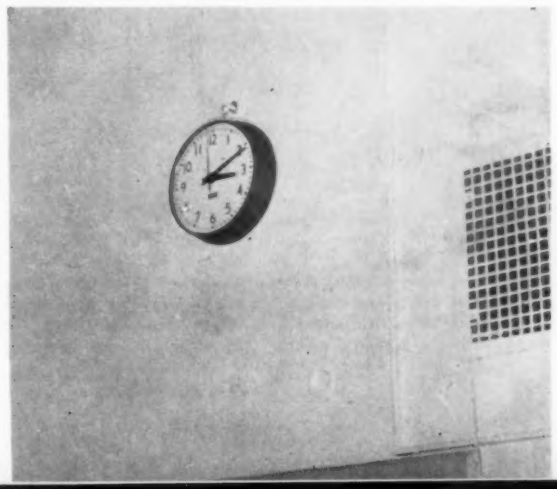
Power for the M-G frequency converter is derived from the nearby 480-volt, 3-phase power panelboard. A circuit of three No. 8's in $\frac{3}{4}$-in. conduit is run from a 50-amp, 3-pole spare CB to the motor starter on the wall of the generator room. From the starter, three No. 8's and two No. 14's for control are carried in a 1-in. conduit run to the motor end of the M-G set.

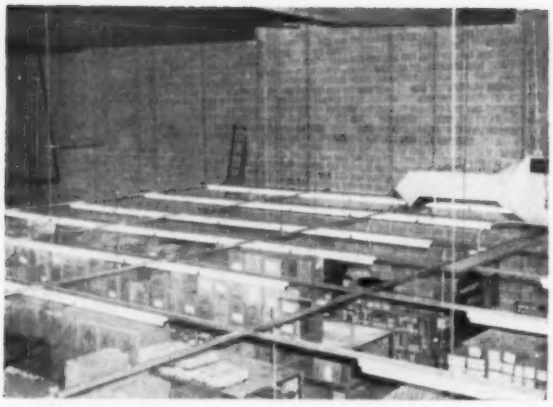
Installation of the many electronic clocks throughout the academy was a much simpler, more direct matter. In many classrooms, it was only necessary to mount the clock near an existing convenience receptacle. In other places, surface raceway extensions of branch circuit wiring were made to receptacles mounted on walls at the new clock locations. All of the branch circuit wiring used standard techniques and was concerned only with properly energizing the motor of each clock.

OIL-FUSE CUTOUTS for the signal feeders to the commercial power section and one generator section of the main switchboard are shown here mounted on top of the main switchboard on the balcony. These are indicated in accompanying diagrams of the overall installation. The feeders are tied into the bus through these cutouts.

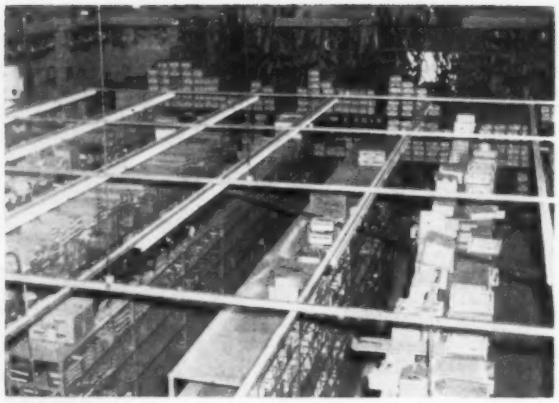


TYPICAL CLOCK controlled by the high frequency synchronizing pulses is this one in a classroom. Clock is powered by plug connection to 120-volt receptacle on circuit from local lighting panel. Pulses are transmitted to this clock from the main switchboard bus, through a step-down transformer, along the feeders, subfeeders and finally the branch circuit.





CHANNEL GRID over parts storage bin area is supported by ⅜-in. metal rods attached to roof trusses.



CLOSE-UP of grid shows continuous rows of 40-watt fluorescent fixtures connected to metal framing.

Channel grid provides

Unique Support for Storage Bin Lighting

40-watt fluorescent strip lights mounted on a channel-supporting grid and suspended from a high ceiling by ⅜-in. rods, provide a shadowless means of lighting for parts storage bins.

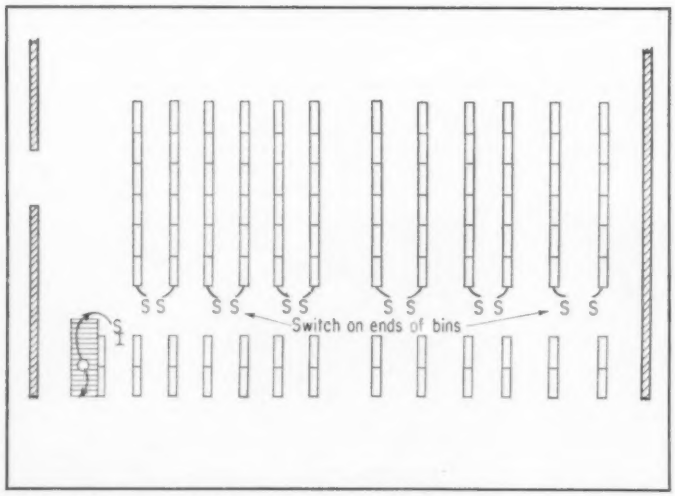


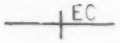
DIAGRAM shows typical layout of 12 rows of 40-watt instant start fluorescent strips as stationed in between the rows of double 8-ft parts storage bins. The system provides 10 fc of lighting at floor level.

AN UNUSUAL mounting method to support continuous rows of 40-watt fluorescent strip lighting is employed in the parts storage section of the Auto Parts Company's new building in Davenport, Iowa. The two-story structure is divided into four sections; machine shop, display room, office area, and parts storage. In the parts storage department, rows of 8-ft steel bins are used to hold the numerous number of auto parts that are kept in stock. Above this particular area there is no second floor. Therefore, because of the high ceiling, lighting the area in between the rows of bins presented a problem. This was especially true since the owner requested that as little wiring as possible be attached to the bins themselves—plus the fact that the

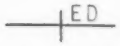
[Continued on page 116]

DATA SHEET

GRAPHICAL ELECTRICAL SYMBOLS

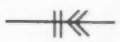


Conduit — empty

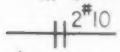


Duct — empty

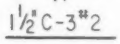
½-in. conduit — 2 No. 12 wires


¾-in. conduit — 4 No. 12s

1-in. conduit — 5 No. 12s

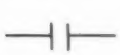


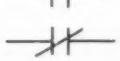
¾-in. conduit — 2 No. 10s

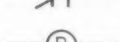


Larger sizes of conduit and wire

Ground wire


Contact — normally open


Contact — normally closed



Relay

Overload

Combination receptacle and telephone duct

Conduit riser — up

Conduit riser — down

Ground rod

Lighting fixture — with circuit number and switch control letter

Fluorescent fixture

Floodlight — mercury vapor

Floodlight — MV with frame-mounted ballast

Fixture — with type letter and wattage number

Floodlight — incandescent

WP Weatherproof

Door position indicator

Tank level indicator

Pump running indicator

Switch — single pole letter designates outlet

Switch — limit — low level

Switch — limit — high level

Switch — disconnect — fused

Transformer

Relay

Work center — outdoor

Heater

Thermostat

Terminal cabinet with vertical barrier for tel. and special systems

Starter — magnetic — non reversing

Starter — magnetic — reversing

Starter — manual

Clock outlet

100-amp 480-volt 3-wire 4-pole

60-amp 480-volt 3-wire 4-pole

20-amp 120-volt 3-wire twist-lock

20-amp 120-volt 2-wire 3-pole twist-lock

20-amp 120-volt 2-wire 3-pole twist-lock with dropcord connector

Horn — fire alarm

Horn — paging

Chimes — paging

Bell — paging

Valve — elec. operated

Valve alarm — sectionalizing

Valve alarm — post indicator

Riser alarm

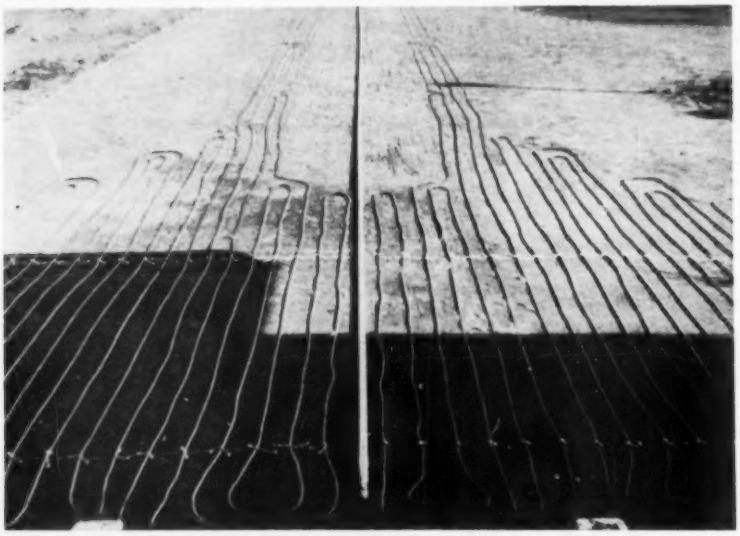
GRAPHICAL ELECTRICAL SYMBOLS show a steady trend towards standardization, promoting positive "meetings of the mind" when various parties involved in construction and installation refer to plans for guidance and interpretation. However, with electrical work constantly increasing in scope and complexity, it is inevitable (and desirable) that new symbols should occasionally be devised and that some of the older symbols clarified. For that reason we here present a collection of symbols used by Holmes & Narver, Engineers-Constructors of Los Angeles. Since this comprehensive collection of identification marks has proved useful on numerous large-scale projects throughout the southwest, it is presented for consideration of those who may be faced with installations of similar complexity.

Heating Cable for Snow Removal

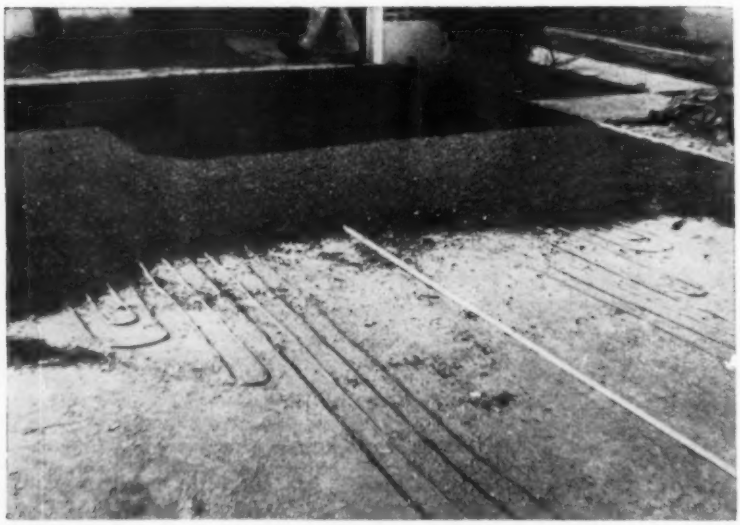
ELECTRIC HEAT

Ample opportunity to test the efficiency of heating cable for snow removal was afforded a West Hartford, Conn., home owner who decided last fall that shoveling was not the best way to get rid of snow in a driveway. West Hartford, in common with most of New England, was plagued with snow last winter. The first real test for the cable installation came early in January when an official 10-in. fall was recorded. Drifting made many spots much deeper. Throughout the storm, the heating cable installation was able to keep the apron in front of the garage doors and the wheel tracks free from snow. In fact, the system provided sufficient heat to lower the snow blanket about 50% between the tracks as well as for a distance of 2-2½ ft on either side of the tracks.

SNOW REMOVAL from this residential driveway was provided by electric heating cable embedded under the surface. This photo was taken immediately after snow had stopped falling. Pattern of removal corresponds to area covered by layout of cable. Area cleared was enlarged at both ends of drive to permit easier movement of car.



HEATING CABLE is shown here (looking from the garage out to the street) as it was installed before the blacktop was poured. In foreground, cable is laid out for the full width of the apron to a depth of 8 ft for the 2-car garage. Beyond, the cable is arranged for only the width of the wheel tracks, about 2 ft wide. At the street end of the 70-ft driveway, the cable is again laid out to provide heating for a wider area. Circuit connections are shown in foreground. Conduit down center of driveway carries home-runs for circuits at street end.



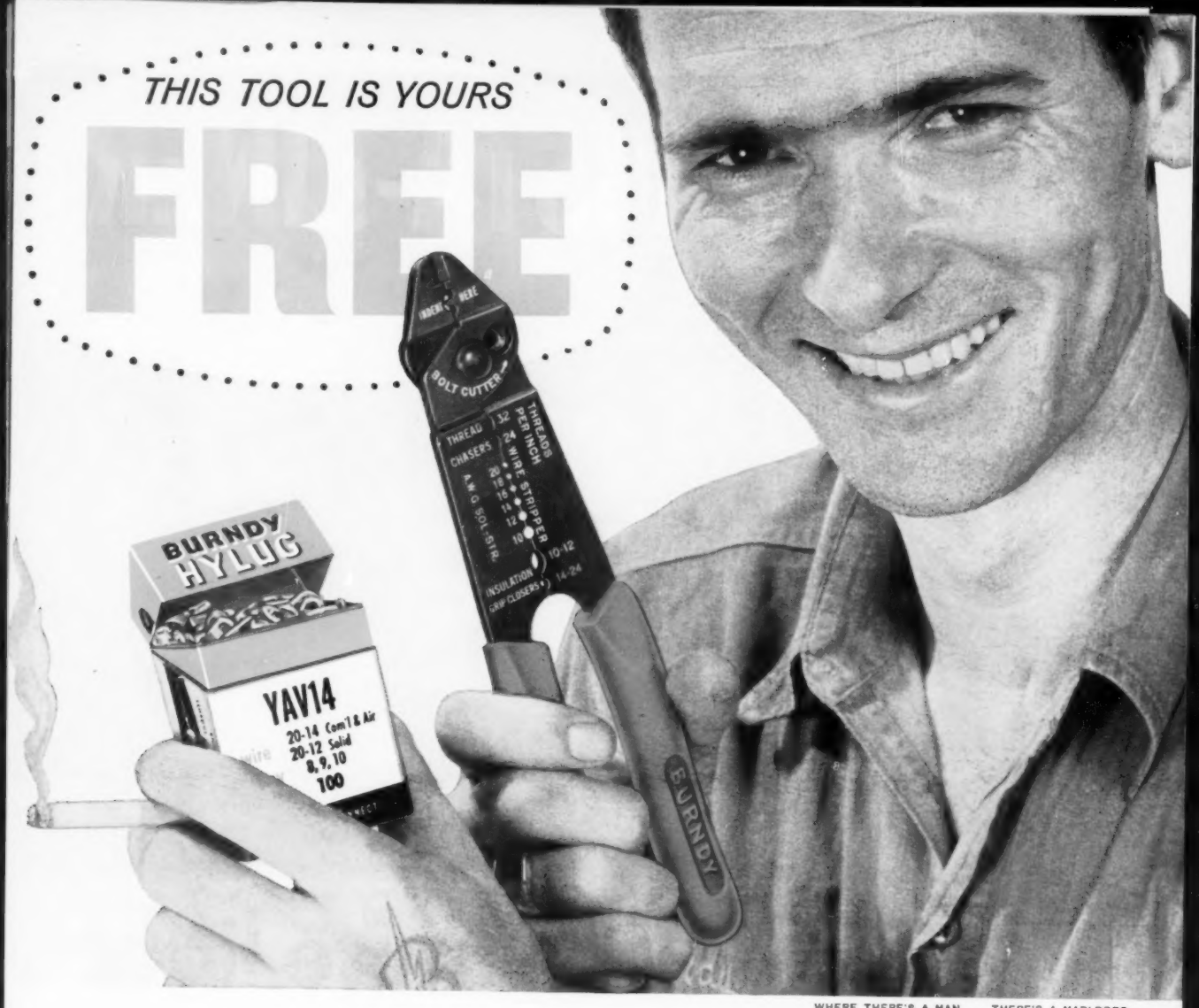
FINAL STEP in the installation is the covering of the cable and conduit with blacktop which was then compressed by rolling and allowed to harden.

In this installation, approximately 1200 ft of General Electric lead-sheathed, Flamenol jacketed heating cable was laid to full width in front of the garage doors, tapering to wheel tracks 1½ ft wide for the rest of the length of the driveway. The cable was laid in 12 different circuits on 4-in. centers having a heating capacity of 30 watts per sq ft. Separate circuits were used as it was estimated that this type of installation, although having a slightly higher initial cost, would offer savings on electric power. Snowstorms in this locality tend to drift. If a storm piled more snow up against the doors, for instance, this portion of the installation could be kept turned on longer. If snow drifted to one side of the driveway, then the one side could be turned on and the other left off. Or again, in a light snow where there would be no need to clear off wheel tracks, the apron where people would walk to open and close garage doors, could be kept clear and dry.

By the end of February, after a succession of heavy storms, the West Hartford owner felt that the cost of clearing snow by electricity was well worth it. He estimated that, to keep the apron and wheel tracks clear during the 10-in. snow fall for the 70-ft-long driveway, power consumed was about 12 kwh for each hour of operation of the

THIS TOOL IS YOURS

FREE



WHERE THERE'S A MAN . . . THERE'S A MARLBORO

WITH THE
HYLUG KIT #11

You get the $3.95 tool FREE of any extra charges in every HYLUG KIT #11. It cuts bolts, crimps on HYLUGS, cuts and strips wire — and fits your hand the way a tool should. You also get 250 HYLUG terminals in three Flip-Top boxes . . . sizes 18, 14 and 10. Do the job the modern way . . . flip out the HYLUGS you need as easily as reaching for a cigaret. See for yourself . . . call your local Burndy distributor and tell him you want to see the Kit. You'll breeze thru your next wiring job with Flip-Top HYLUGS and the Burndy HYTOOL.

Items bought separately cost $11.45

price of Kit #11 complete with Y10M HYTOOL **$6.50**

HYLUGS in Flip-Top boxes come in 29 popular sizes.

BURNDY

Norwalk, Connect.

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Toronto, Canada

New VISTA-LINER

20% to 30% more light

than any other fluorescent flood-lighting equipment

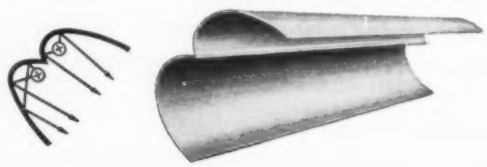
With "Squared Beam" Control!
Makes flood-lighting easier
than ever to sell-apply-install!
Opens new vistas for lighting!

This new Westinghouse VISTA-LINER gives you, as an electrical contractor, opportunities for flood-lighting sales like you have never had before!

Vista-liners have the first truly ultra-modern appearance—a unique design that your customers can point to with pride, today and for years to come!

Westinghouse Vista-liners are the first fluorescent floodlights to take advantage of the new super-high-output fluorescent lamps—and do it in a way that appreciably increases luminaire output! Then they provide a sharply defined control of light distribution—that formerly was possible only with incandescent lamps!

They are the first to use the new Bryant snap-in sockets, with stainless steel springs that *do not carry current!* This means less maintenance and improved lamp performance.



This superior Alzac-processed reflective surface is specially contour-engineered, by Westinghouse, to better serve *each* lamp.

by Westinghouse

per watt

This new contour gives Vista-liners a dual optical system with 15% more reflective surface than other designs, to direct the light-source rays. Furthermore, this reflector is shaped so that fewer light-rays are absorbed. Fewer are trapped in opposing lamps. At least 15% more lamp-lumens are released! And Vista-liners produce from 20% to 30% *additional* light from the *same* input! J-04457

YOU CAN BE SURE...IF IT'S

Westinghouse

"Squared Beam" Control Simplifies All Flood-lighting Plans!

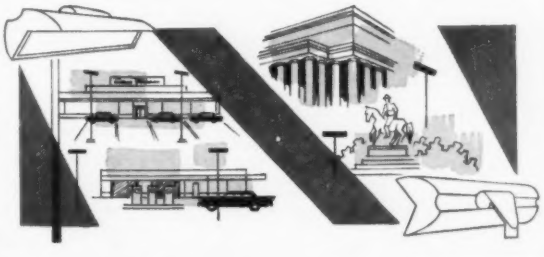
The Vista-liner housing has "square" ends. Its lens is rectangular. Its optical system therefore projects a relatively "squared beam."

This simplifies all flood-lighting applications. It is easier to plan for and distribute squared areas of light than it is to arrange round areas. The difficulties of over-lapping light-beams do not occur! No light need be wasted beyond the area or the subject to be flood-lighted! And complaints over glare are eliminated!

VERSATILE AND RUGGED

Vista-liner housings of indestructible fiber-glass are especially light in weight. A wide variety of cast-aluminum brackets permits the mounting of Vista-liners virtually "anywhere"—close to the pole—or on adjoining structures. New design ballasts, with separate capacitor —rugged in construction for outdoor service—are mounted inside the cast-aluminum bracket. Since ballast heat is removed from the optical system, the lamps operate at a more efficient temperature.

Call your Westinghouse Lighting Distributor, today, for help with any flood-lighting problems you may have. Or write directly to Westinghouse Electric Corporation, LIGHTING DIVISION, Edgewater Park, Cleveland, Ohio.



There are *MANY* helpful hints on permanent *Masonry Anchoring* in this *NEW RAWL HANDBOOK & CATALOG* of **MASONRY ANCHORING** and **DRILLING DEVICES**

CATALOG No. 24
RAWL
PRODUCTS
Catalog
Anchoring and Drilling Devices for Fastening Anything to Masonry
for engineers, architects, and all users of masonry anchors

This pocket-size manual not only contains data about diameters and lengths of all **RAWL** products for fastening anything to masonry but also gives you complete information on . . . **HOLDING POWERS • DRILLING HINTS • TYPICAL APPLICATION TABLES and WHICH RAWL PRODUCTS TO USE IN DIFFERENT MASONRY MATERIALS.**

An excellent reference for specification writers, architects, engineers and all users of masonry anchors.

WRITE FOR FREE CATALOG No. 24

entire system. Assuming that the charge per kilowatt hour would be approximately 2½ cents, this "snow shoveling" job would cost only 30 cents for each hour of operation.

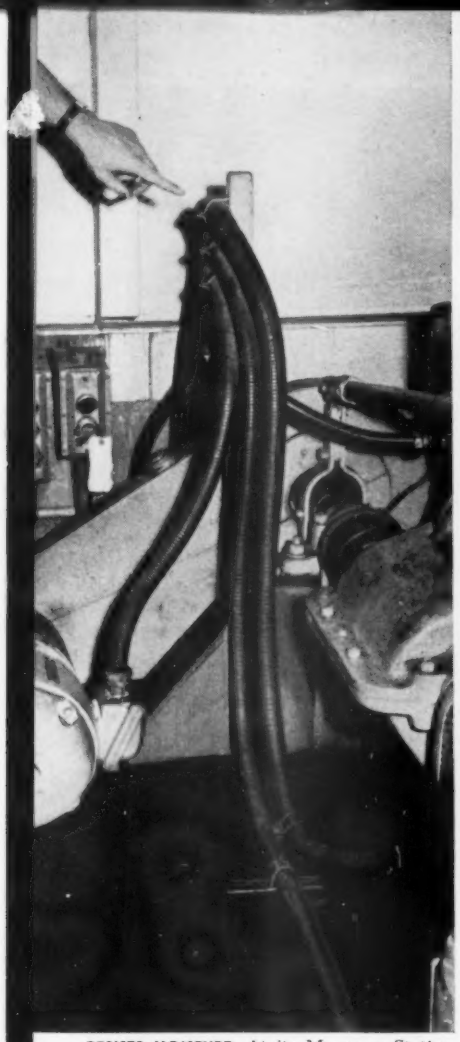
Baseboard Raceway For Modernization

DESIGN

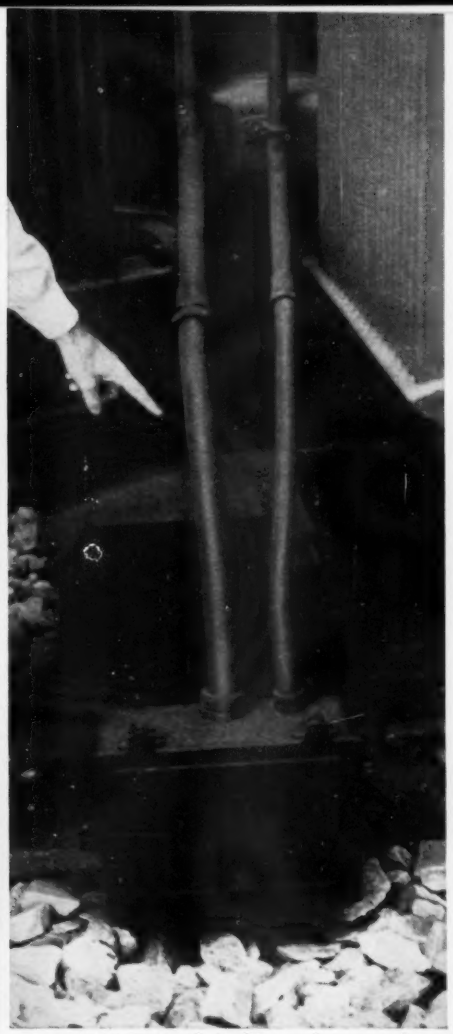
Unusual "time pressure" posed serious installation considerations for Carter Electric Company in modernizing the outmoded electrical facilities of a 4-story office building in Pittsburgh, Pa. With tenants moving into the structure even before general renovation was completed, it was necessary to provide electrical accommodations for immediate lighting, power, telephone and inter-office communications—at the same time allowing for future expansion. Carter Electric found the answer to problems of both expediency and expansion in Twinduct—a dual-service electrical distribution system developed by National Electric Products Corporation.

Installation of Twinduct at the baseboard level around the interior perimeter of upper floors of the building permitted the electrical firm to provide modern, full-capacity circuiting with maximum speed and ease. This surface raceway installation—with two runs of metal duct under a single screw-type cover—provides separate accommodations for a high potential wire fill up to ten No. 6 AWG Type TW conductors, and low potential

RACEWAY SYSTEM along baseboard provides two separate channels—one for power and light wiring and one for communication facilities—providing fast, effective modernization of a Pittsburgh office building.



RESISTS MOISTURE. At its Meremac Station, the Union Electric Company of St. Louis puts Sealtite to work in a real moisture spot—a sump pump.



RESISTS DIRT. Here's Sealtite working outside at Union Electric's Venice, Ill., plant. Sealtite is used to connect transformer and control to main switch room.

RESISTS OIL. Sealtite installed on a traveling screen drive at water intake of Meremac Station. Oil from gear housing and moisture from Mississippi River are hazards.

Sealtite flexible, liquid-tight conduit can "rough it" indoors or out!

At the Meremac Station of the Union Electric Company of St. Louis, Sealtite* was used because of its resistance to moisture, oil, and dirt. How has it worked out? Very well, even after 5 years of tough usage near pumps, controls and drives.

Sealtite has a tough, extruded polyvinyl jacket that delivers true wire protection under even the roughest conditions—conditions that would corrode most metal conduit. In addition, Sealtite is easier and less costly to install . . . especially in cramped spaces. It's ideal where conduit must flex or be moved, absorb vibration or join misaligned outlets.

WHERE TO GET SEALTITE — Electrical Wholesalers stock Types U.A. and E.F.† Sealtite in easy-to-handle coils, in black or gray. Be certain you ask for and get the quality conduit marked "Sealtite" on the cover. Buy it in long lengths on reels or in cartons and cut it on the job without waste. Your wholesaler also stocks liquid-tight connectors. Free Booklet S-538 gives full information on Sealtite. Write: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. Sealtite is approved by Canadian Standards Association.

*Reg. U.S. Pat. Off. †Pat. Applied For 57179

CUTAWAY SECTION of Type U.A. Sealtite shows tough polyvinyl jacket over flexible metal core. Copper conductor wound spirally inside conduit gives positive ground.

Insist on the conduit marked **SEALTITE**

FLEXIBLE, LIQUID-TIGHT CONDUIT

an **ANACONDA®** *product*

raceway facilities for 50-twisted pair telephone wires or several 26-pair cables. The screw-on cover can be readily removed for access to the individual duct runs, permitting the addition of wiring as it may be needed. The Carter electrical team reported installation of approximately 180 ft of the raceway per day—even in tile areas where it was necessary to employ toggle bolts instead of the expansion shields used for mounting duct along conventional wall areas.

In this building, the electrical baseboard raceway installation ties in with a partition system of built-in raceways. Two 20-circuit panelboards are installed on each of the upper floors and in the basement of the rewired building, with a single board serving the first floor. Rigid conduit runs, installed beneath the surface of the floor carries wiring from the Twinduct and partition distribution systems to centrally located junction boxes. Underfloor extension of the surface raceway electrical system lends balance to the overall installation and assures adequate, conveniently located outlet accommodations.

Trailer Provides Jobsite Material Storage

STORAGE

Purchase of a large semi-trailer by Union Electric Co., Inc., of Richmond, Va., has paid dividends in convenience resulting from its use for on-the-job storage.

Normal construction operations require a large storage shed, supplies being trucked in as they are needed for each phase of construction. Union Electric, however, has profited by loading into the trailer all wire, cable and other bulky material and hiring a tractor at small cost to haul it to the jobsite, where it remains until completion. This makes unnecessary the usual repeated shuttle trips by smaller trucks and eliminates much double handling of materials—an important consideration where large or heavy items are involved. It has also proved practical to park the trailer at a railroad siding close to the job, supplies being transferred directly from the freight car to the trailer.

When an extra-large job is encountered, the trailer is first loaded with all roughing-in supplies needed. Then it is hauled back to the shop and loaded with lighting fixtures and other finishing materials. Where progress of the job dictates a more expedient location for the supplies, a tractor is hired (usually from another contractor right at the site) to move the trailer. This eliminates the laborious job of tearing down and reassembling a storage shed.

The trailer has also been found practical for several small jobs occurring simultaneously in one general area far removed from the shop. Material for all the jobs is loaded, and the trailer is parked at the job most centrally located. Individual pick-up trucks can then make the comparatively short run to the trailer for supplies rather than to the home shop.

When the trailer load is relatively light, space is also available for office space for the job superintendent.

TRAILER STORAGE of bulky materials reduces size of storage shed on jobsite, reducing indoor storage to small items such as switches, contactors, fittings, etc.

Concrete Drilling For Conduit Feeders

CONSTRUCTION

Sachs Electric Corp. thought it had a tough job in the cutting of 150 holes through 10-in. reinforced concrete floors for new conduit feeders in the old Mart Building which the U. S. Government bought to house all defense agencies in the St. Louis area.

The project appeared tough because the concrete used in the construction of the building in 1932 was Meramec gravel—"the next thing to flint"—say Norman Krause and Harry Martin, Sachs' engineers. Cutting holes manually through this concrete results in jagged, uneven holes for conduits and service lines—and days of time and labor. Sachs solved the prob-

BRONCO CERTIFIED 66

Neoprene Control Cable

BUILT FOR HEAVY DUTY SERVICE WHERE AN EXTRA FLEXIBLE MULTIPLE CONDUCTOR ELECTRICAL CABLE IS NEEDED

JACKET is certified by a registered professional engineer to contain not less than 67.32% Neoprene ...for maximum protection against oil, ozone, sunlight, flame, acids and alkalis. A signed certification is affixed to each reel.

BRANDED with complete data — name, type, size, number of conductors, rated voltage — every two feet, exactly; makes it the only cable that is self-measuring.

SYNCHRO-CURED — vulcanized by the exclusive patented BRONCO process. This, plus fine stranding, and special engineering, results in flexibility which is absolutely unique in cables of this size.

UP TO 36 CONDUCTORS. Bronco 66 Certified Portable Control Cable is made with from 5 to 36 conductors. It is also made with electronic shielding and in stationary types.

COLOR-CODED INSULATION. The high quality Buna S insulation around the single conductor is colored and striped in accordance with the NEMA code.

ORDER THE LENGTH YOU REQUIRE. IT WILL BE SUPPLIED AT NO ADDITIONAL COST.

SALES OFFICES IN ALL PRINCIPAL CITIES

16 LOCAL AND 3 CENTRAL SERVICE CENTERS THROUGHOUT THE COUNTRY...OVERNIGHT SERVICE TO ANY CITY IN THE COUNTRY

WESTERN INSULATED WIRE CO.

America's fastest growing specialist manufacturer of portable electrical cords and cables

LOS ANGELES 58, CALIFORNIA

extra flexible **HEAVY DUTY NEOPRENE CONTROL CABLE**

TYPE **SO**

U.L. APPROVED

portable electrical CONTROL CABLE with up to 66 conductors protected by 67.32% NEOPRENE jacket

BRONCO

CERTIFIED **66**

Attractive by day . . . effective by night

Graceful continuous taper, fluted or plain round designs, steel or aluminum . . . Monotube poles are the preferred choice for every area lighting requirement.

For complete details and helpful information on *any* type of on or off-street lighting, write The Union Metal Manufacturing Company, Canton 5, Ohio. In Canada: The Union Metal Manufacturing Company of Canada Limited, Brampton, Ont.

UNION METAL

Monotube Area Lighting Poles

DRILLING MACHINE with diamond bits was used by Sachs Electric Co. to drill 150 holes through a 10-in. reinforced concrete floor to provide for conduit feeders in the modernization of the old Mart Building in St. Louis, Mo.

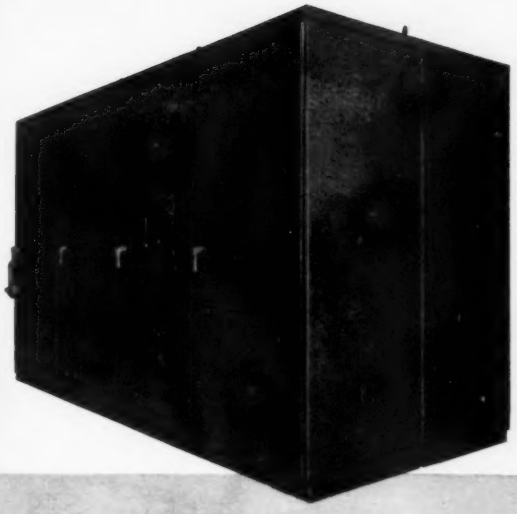
lem by getting a Truco portable drilling machine and Truco diamond bit, made by Wheel Trueing Tool Co. of Detroit.

This drilling unit was specifically designed for fast, one-man operation and is equipped with a telescoping post that can be anchored firmly between the floor and ceiling. Drilling is simply a matter of advancing a motor carriage along a track.

With this drilling machine and diamond drill bits, the Sachs operator drilled smooth, 3½-in. holes through the 10-in. concrete floor in just six to nine minutes per hole. The time varied depending upon whether or not reinforcing bars or conduits had to be cut. This six to nine minutes can be compared to the operation of manually drilling the holes, which ordinarily would take two men about six hours to complete. Hammering and chiseling are eliminated; and there is no break-out around the edges and no big clean-up job.

The lightweight drilling machine is wired for 110 volts and 60 cycles. The telescoping post is mounted in heavy cast base with two 6-in. diameter rubber tired wheels for quietness and easy maneuverability. The head swings through 360 degrees to easily cut holes at any angle. To supply the water required to flush away the cuttings, Doyle Hall, general foreman for Sachs, rigged up a recirculating water tank using a standard 54-gal oil drum and 10 ft of ordinary

for high voltage service continuity on your critical loads at lower capital outlay— it's S&C Metalclad Switchgear!

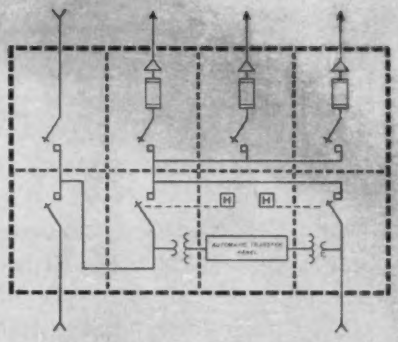


To get service continuity on critical loads, you need preferred-to-emergency switching of your alternate incoming high-voltage supply circuits, and short-circuit protection and switching on your outgoing high-voltage supply feeders. All of this can be provided in one low-cost package in S&C Metalclad Switchgear, as illustrated.

You even have built-in choices of throwover schemes through S&C's standard automatic transfer panels.

You save two ways:

1. You get metalclad switchgear with job-matched load interrupters and power fuses, in lieu of costly circuit breakers.
2. You eliminate cost of custom designing by using an off-the-shelf transfer panel with built-in options.



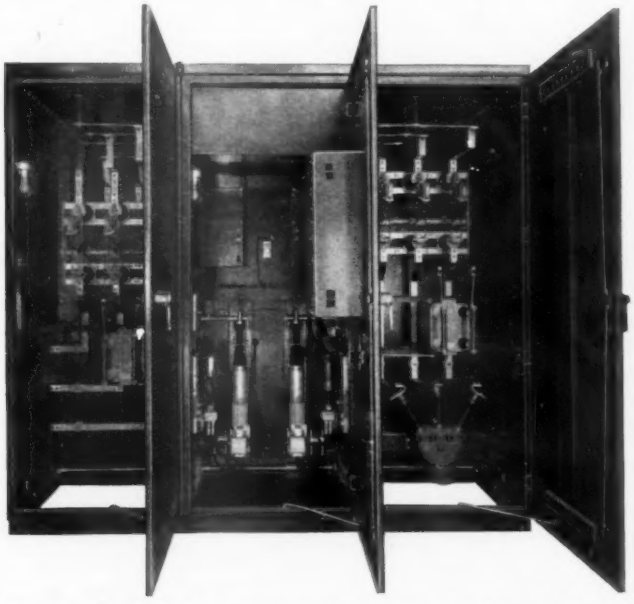
Schematic for 8-bay switching center unit (above) shows throwover control of 2 of 3 alternative incoming sources to provide continuous service for three outgoing feeders.

S&C Standard Automatic Transfer Panel provides for making either source preferred, for automatic or manual return, for adjustable time delays, for choice of returning in either open or closed transition, and for optional lockout on bus faults.

No organic insulation to cause corona trouble; porcelain and air only.

High-Speed Automatic Switching.

Full-length bulkhead doors; rainproof, with complete access.



Super Durabake finish with galvanized and stainless steel hardware; withstands corrosive atmospheres.

Separate compartment for Moto-Draulic operators; free access and decoupling for checkout.

Strip heaters with adequate venting prevents moisture accumulation.

Power Fuses
Tool Operated Disconnects
Open and Enclosed Cutouts
Fuse Links
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8 Vansco Road, Toronto 14, Ontario

Be sure
it's a genuine
CHANNELLOCK

Only Channellock has this reinforced edge for greater strength.
Only Channellock has undercut interlocking non-slip channels.

LOOK FOR THIS TRADE MARK

Why? Only Channellock has undercut interlocking channels that can't slip no matter how tight you grip. Only Channellock has the reinforced tension edge to withstand maximum gripping force. These exclusive features have made the Channellock No. 420 the first choice of skilled mechanics everywhere. So be sure you get only genuine Channellock pliers. Look for the trademark on the handle.

ASK YOUR TOOL SUPPLIER FOR CHANNELLOCK PLIERS—BY NAME

CHAMPION DeARMENT TOOL COMPANY
MEADVILLE, PENNSYLVANIA

garden hose. This compact unit, plus the portable drilling machine, and other needed equipment can be moved from place to place on a small, 30- by 60-in. portable platform truck.

Sachs now is able to drill an average of two holes an hour. This supposed hardest and most time-consuming part of the big job—drilling—has turned out to be the easiest and fastest.

Elbow Storage Rack

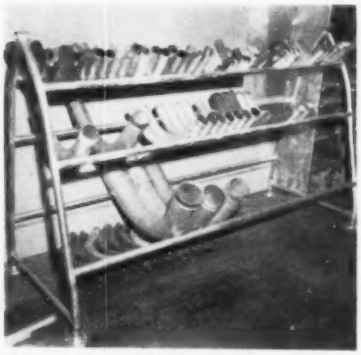
STORAGE

Storage of conduit and steeltube manufactured elbows is simplified by use of a welded steel rack designed and constructed by Baer Electric Co., of Moline, Ill.

The rack built completely from 1-in. scrap conduit and parts is used to store elbows from ½ in. through 4-in. It measures 8 ft long by approximately 4 ft high. The space between the floor and the first tier is 12 in. At this point it is 30 in. deep and will handle elbows up to 4 in. in diameter. From the bottom tier to the second tier, the distance is 18 in. And at this point the rack is 12 in. deep. This space is designed to hold medium size elbows. The top tier is located 12 in. above the second tier and is 12 in. wide. ½-in. through 1¼-in. elbows are stored on this shelf.

The four vertical members are bent slightly to meet the three horizontal shelf dimensions.

The A-frame structure bolted to the floor by use of 1 in. floor flanges provides a visual and sturdy rack for all sizes of elbows. By using this basic design, the rack could be expanded in both height and length to solve any elbow storage problem.



VISUAL ELBOW STORAGE RACK designed and constructed by Baer Electric Co., simplifies the storage problem of conduit and steeltube manufactured elbows.

Used by MORE CONTRACTORS than any other brand- BY MILLIONS EVERY YEAR!

Some surveys have shown IDEAL Connectors first choice by up to *5 to 1* over the next leading brand. *Maybe so!* The important fact — proved by continuing surveys — is that contractors just plain like IDEAL Connectors *better,* for *more* jobs than any other brand — by millions! They know they can depend on them to perform as promised.

In short, these contractors KNOW QUALITY — WANT QUALITY — and BUY QUALITY.

If you aren't using IDEAL Connectors, you're in a minority. *Better check your reasons* — or join the switch to America's top brand of Wire Connectors — IDEAL.

IDEAL

WIRE CONNECTORS

IDEAL Wire-Nuts® CONNECTORS

the lifetime-tight, wire crushing grip that **NEVER LET'S GO!**

- just screw them on — like a nut on a bolt!

Use new "Wire-Nut" wrench if you like.

Screw-and-lever and wedge action with **FORCE OF UP TO 2½ TONS** flattens wires and multiplies contact area

NOW — BETTER THAN EVER

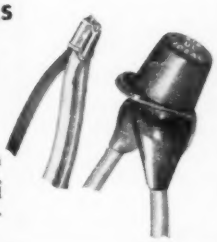
Stronger!
Closer tolerances!
Easier to Use!

SHAKE-PROOF! PULL-PROOF!
FLASH-PROOF! HEAT-UP PROOF!

IDEAL **CRIMP CONNECTORS** with the UNIQUE "Wrap-Cap"

(Patented) INSULATOR

A stronger crimp sleeve of cadmium plated steel, diaper-wrapped in perfect, pre-fabricated insulation all-around and double protected over wire ends. Best of the crimp connectors!



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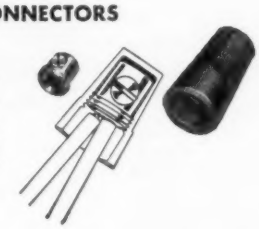
All IDEAL Wire Connectors in all contractor sizes are UL listed as pressure cable connectors, for general use (600 V.) in branch circuit and fixture wiring.

SOLD THROUGH AMERICA'S LEADING DISTRIBUTORS
In Canada: Irving Smith, Ltd., Montreal

IDEAL SET-SCREW CONNECTORS

Set 'em and see 'em! A screw driver's all you need. Permits visual inspection of every joint. A breeze to re-use when making circuit changes. *Solid brass* sleeve and set-screw — long-skirt, *highest dielectric* shell.



IDEAL INDUSTRIES, Inc.
1041-F Park Avenue, Sycamore, Ill.

Please send full catalog data on

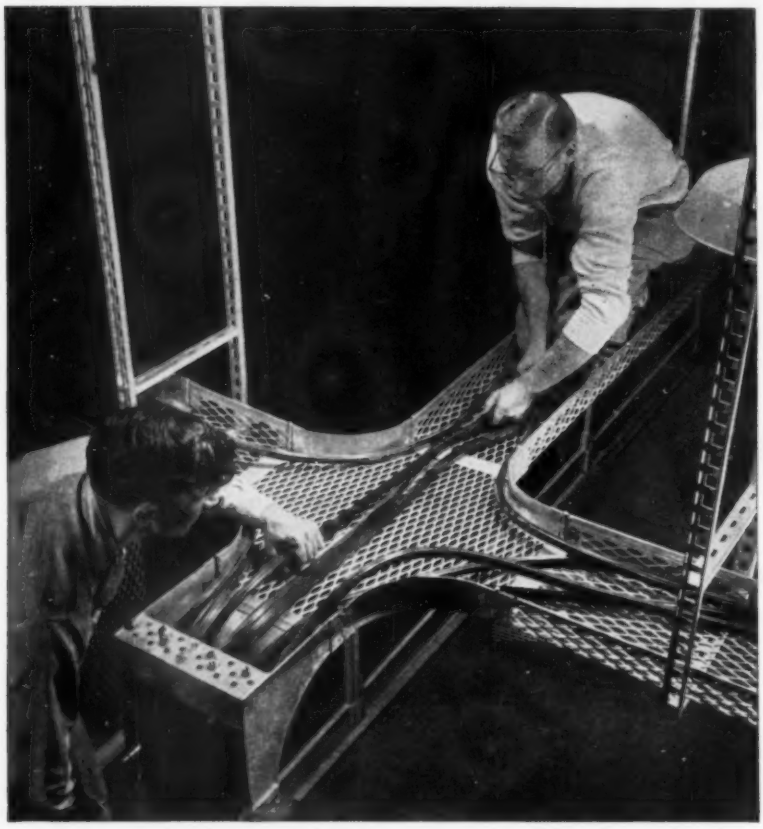
☐ IDEAL "WIRE-NUTS" ☐ IDEAL CRIMP CONNECTORS
☐ IDEAL SET-SCREW CONNECTORS

Name_____

Company_____

Address_____

City_____ Zone_____ State_____



Here's a cable supporting system with space reserved for future needs

Cope cable trough gives your system room for growth!

Cope cable trough design gives you greater load carrying capacity per dollar *now—plus built-in system expansibility* that will minimize the cost of future system expansion. A *single* 24" wide section of Cope cable trough supports as many cables as 16 lengths of 4" conduit. Additional cables can be quickly and easily laid in *existing* trough as new equipment installations require. The lower *first* cost of a Cope cable trough installation *saves you money a second time* when you need to increase or expand your power distribution system!

Reduced System Maintenance Costs. Easy-to-get-at Cope cable trough also eliminates costly maintenance problems down the line. Once cable is laid in Cope expanded metal trough, it's readily accessible for easy inspection, repair . . . or *re-routing* when system changes are required. And greater installation flexibility of lightweight Cope cable trough and a complete line of system accessories and fittings reduce design time up to 25% for laying out the most complicated system . . . assure easy system maintenance even in the most cramped quarters.

Cut Costs Three Ways. You save *three ways* when you specify Cope cable supporting systems with pin-type coupler . . . trough, ladder or channel.

- **LOWER FIRST COST**
- **LOWER INSTALLATION COSTS**
- **LOWER SYSTEM MAINTENANCE COSTS**

Discuss these advantages for *your* installation with a qualified Cope representative—or write to T. J. Cope Division, Rome Cable Corporation, Collegeville, Pa.

1008

T. J. COPE *Division*

ROME CABLE CORPORATION

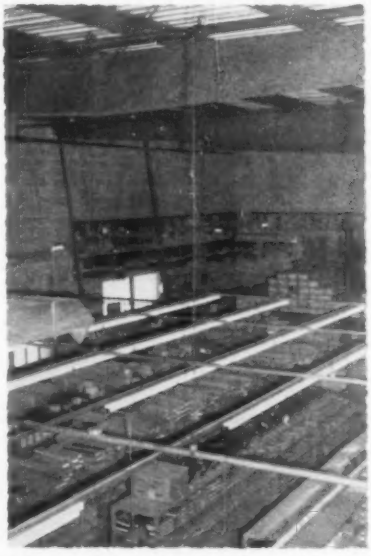
SUPPORT FOR BIN LIGHTING

[FROM PAGE 102]

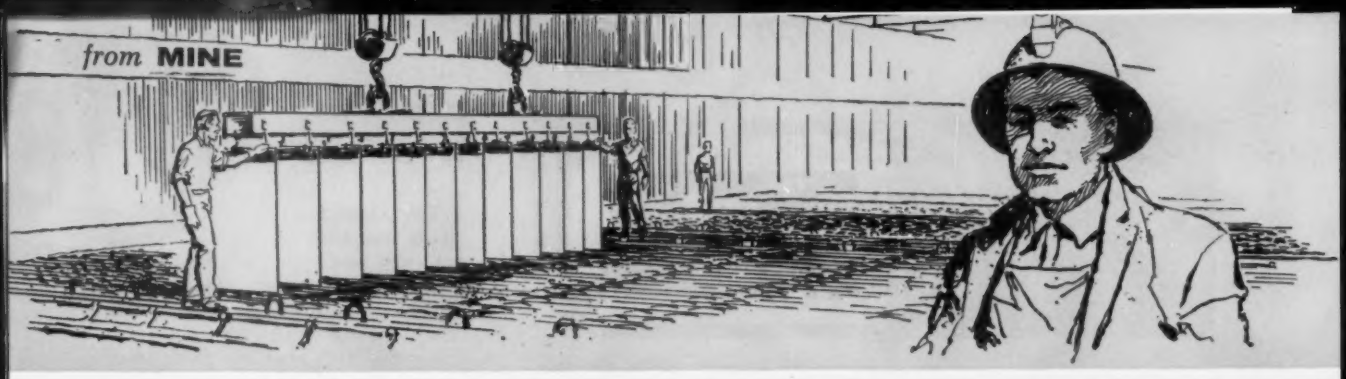
lighting layout had to be easy to maintain, neat in appearance, and economical to install.

The lighting system that was installed by the Tri City Electric Company solved these problems and many more. By using metal framing, they constructed a "grid" that is suspended from the roof of the building by ⅜-in. metal rods. The basic grid consists of four horizontal spans of 60 ft each, which are located on 10-ft centers. It is to these lengths of metal framing that the ⅜-in. rods are connected. Then, attached directly to this horizontal network are 12 vertical rows of the continuous metal channeling, each measuring 40 ft in length and stationed on 5-ft centers. Mounting the fixtures to these vertical runs was the next step in the suspension system. This was carried out by using a specially designed metal framing fixture stud. Finally, after eight 40-watt instant start fluorescent fixtures were connected to each of the 12 vertical rows of channeling, a reading of 10 fc of shadowless lighting at floor level was accomplished between each of the double rows of storage bins.

[Continued on page 118]



SUPPORTING RODS of ⅜-in. were attached to roof trusses by drilling the beams and fastening the rod on both sides of the trusses. The steel rod is connected to the metal framing by ready-made hangers.



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ONE SURE SOURCE OF SUPPLY

for all your wire and cable needs

In wire and cable, contractors look for reliability of product, ample stocks, and friendly service. Working through a Circle distributor, you're assured of all three . . . and here's why.

Take *product reliability*. Quality control begins right with the basic metals mined and refined in Cerro's own facilities. Here skilled men make sure that every bar of copper, lead, or zinc is of the proper purity. This same attention to quality control is maintained throughout manufacture.

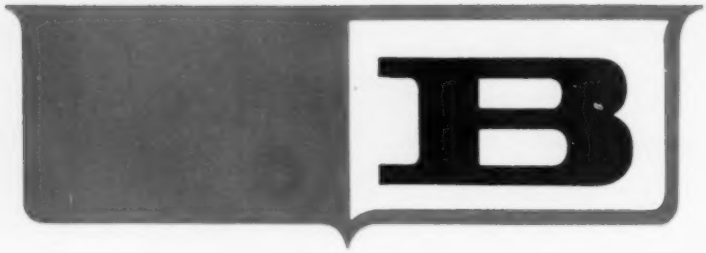
Ample stocks? Circle supplies the trade with over a billion feet of top quality wire and cable yearly – distributed through well stocked, conveniently located warehouses across the country.

Service? There's no "red tape" at Circle. When your distributor needs fast action, a simple telephone call brings results. So make a Circle distributor *your* "one sure source of supply" – many other satisfied customers do.

CIRCLE **WIRE & CABLE**
a subsidiary of
CERRO DE PASCO CORPORATION

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** in all principal cities

RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES
NEOPRENE SHEATHED CABLES • "CIRTUBE" EMT



this shield means . . .

protection

leadership

quality

responsibility

SUPPORT FOR BIN LIGHTING

[FROM PAGE 116]

The added feature of the installation was that the metal framing not only provided support for the continuous rows of lighting, but also served as a raceway for its circuiting and switch legs. This left the entire area over the parts storage section free from all visible signs of wiring, except for the six short drops of conduit from the metal framing to 2-gang surface switch boxes. The boxes, located at the entrance to every other row of bins, provide individual switching for each of the 12 rows.

Installation Simplified

Installation of the channel grid was simplified by determining the exact location of the 12 rows of bins and marking their position on the floor. Then, the entire grid was assembled at floor level and raised to its position in sections.

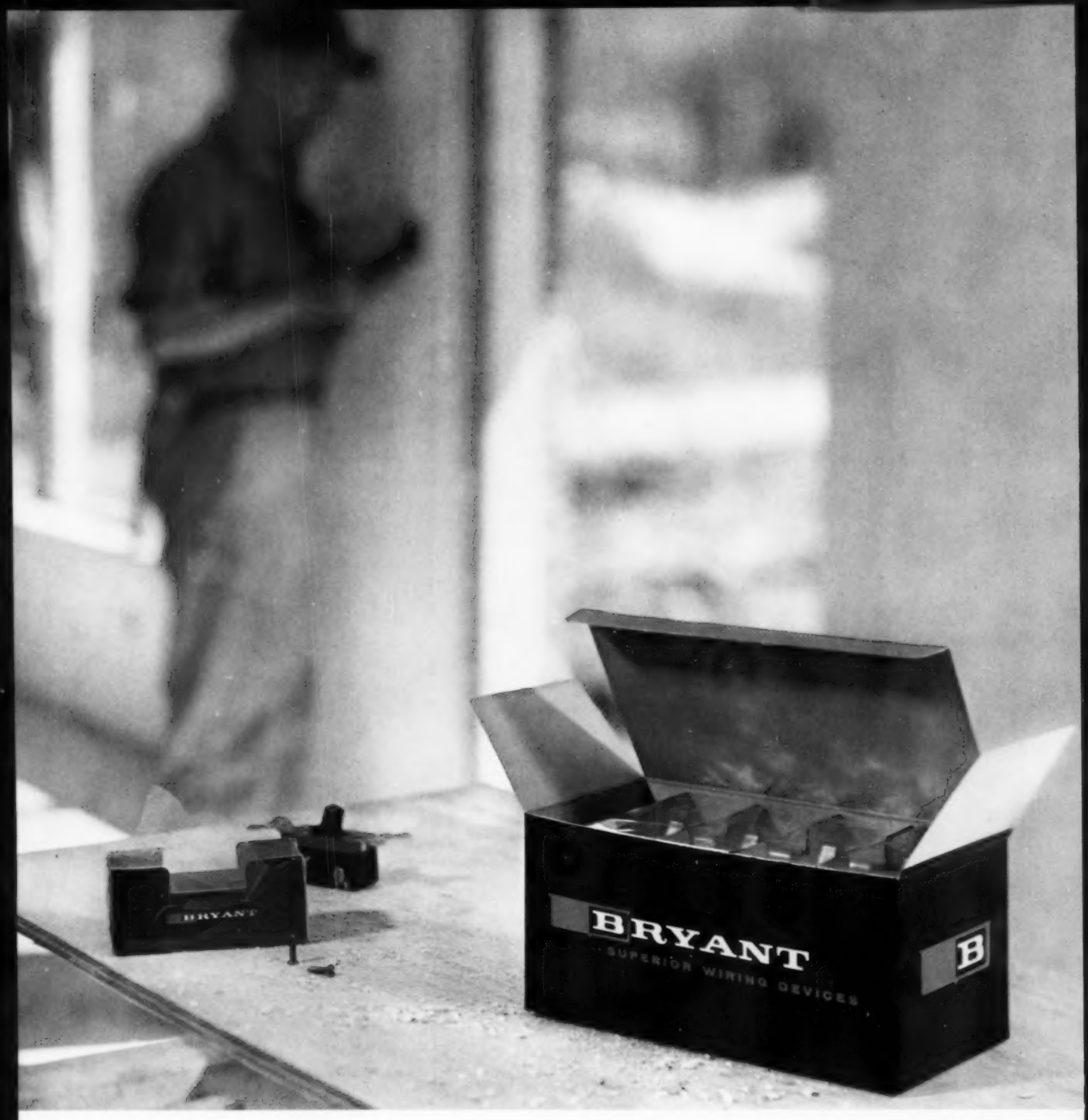
Maintenance-wise, the system leaves little to be desired. If for any reason a fixture has to be removed from the metal framing, it is a simple matter to disconnect it without disturbing the operation of the other fixtures or their circuiting.

Also, the absence of raceway and fixtures on the storage bins permits future moving or replacing of bins with minimum change to the electrical system.

CONDUIT DROPS from junction boxes mounted to metal framing connect to 2-gang surface switch boxes to provide individual switching for each row of lighting.

Look for this shield

then open this carton to see why...



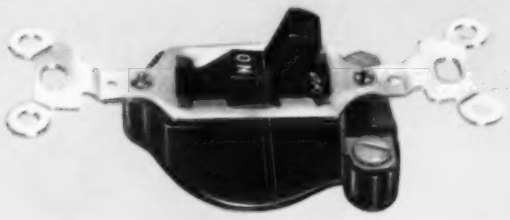
Bryant devices protect reputations

This Bryant carton with the new Bryant shield contains more than a product. It contains a reputation. Wall switch or cutout, outlet or lamp holder, it's built to safeguard your reputation . . . and ours.

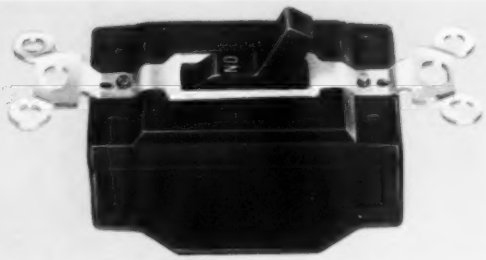
BRYANT B

This safeguard stems from Bryant's willingness to go that added distance in design, engineering and testing to produce the best electrical devices available. For the job where your mark as a trusted craftsman is at stake (and what job isn't), specify Bryant.

Now look for this shield on every quality wiri

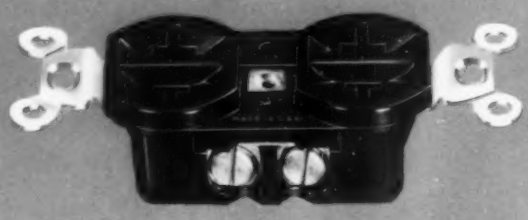


BRYANT 4701 Mercury Switch—operates silently; design gives unusually long wear and permits either top or back wiring.



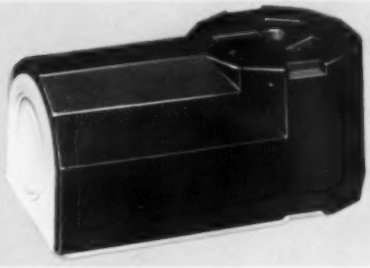
BRYANT 5862 Tumbler Switch—20 ampere. Arc snuffers reduce arcing and contribute to unusually long life.

BRYANT 5642-5662 Grounding Duplex Outlets—exclusive "U"-shaped grounding slot prevents housing breakage. Available in two distinctive types . . . 125 and 250 volts.

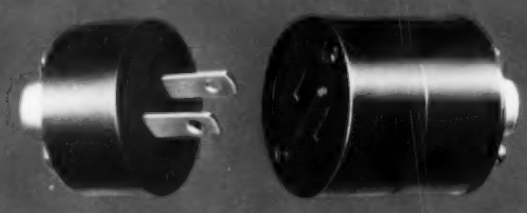


BRYANT 4832 Duplex Outlet—"T" slots, double-sided contacts; all completely enclosed in plastic housing.

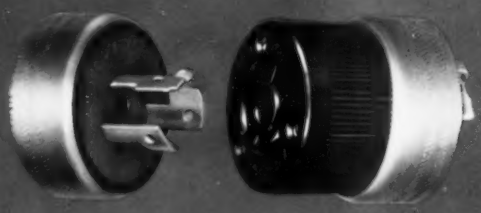
BRYANT 3830 3-Wire Polarized Cord Sets—flat molded cord for easier installation. Non-breakable molded rubber cap and cord for major appliances.



BRYANT 3826 Plastic Receptacle—includes pressure terminals, ¾-inch knockouts for conduit in bottom and back.

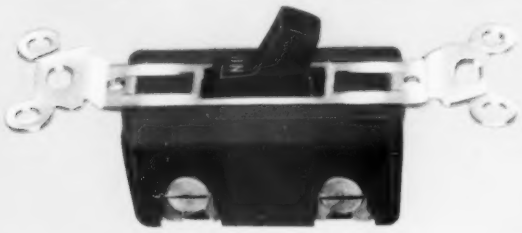


BRYANT 9754-9755 Caps and Connector Bodies—the rubber body and "Fiberite" face make this connector almost indestructible.

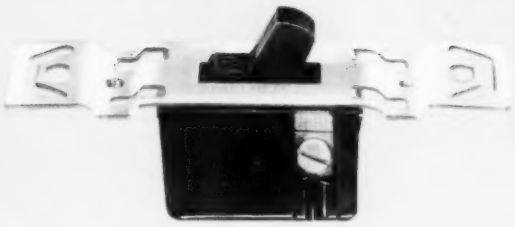


BRYANT 7311-7313 Twist-Lock Connectors—positive lock-fast electrical connection. A twist of the cap and it locks every time.

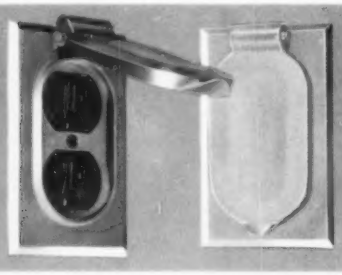
viring device



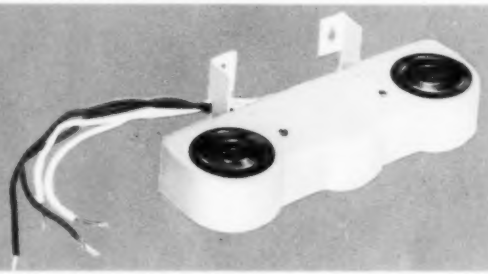
BRYANT 4901 A-C Switch—heavy-duty, single-pole switch with red cover.



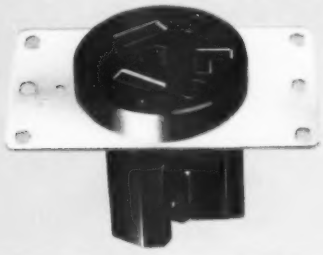
BRYANT 6001 "T"-Rated Switch—competitively priced for residential market.



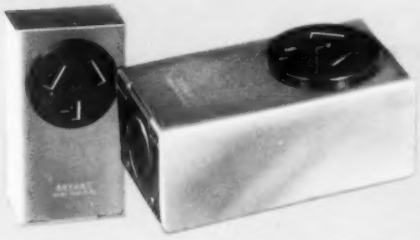
BRYANT 4500 Universal Weatherproof Cover—corrosion-resistant finish. Self-closing rubber-lined lid forms seal against plate.



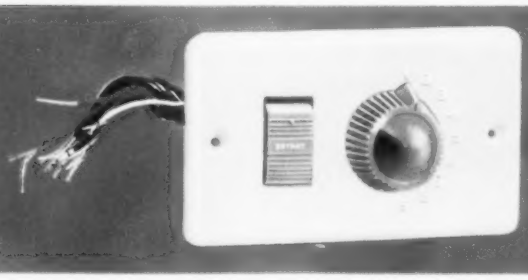
BRYANT 4970 Narrow Bracket Fluorescent Lamp Holder—brackets flex to the side for easy centering when mounting in fixture.



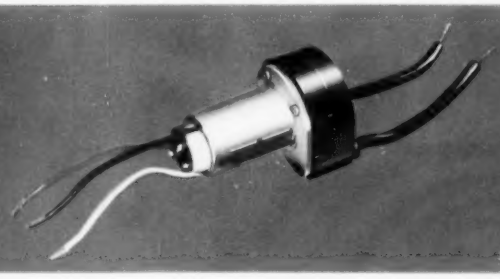
BRYANT 9303 3-Wire Power Outlet—designed with clamp-type pressure terminals for clothes dryers and heavy-duty appliances.



BRYANT 9304 Surface Outlet—aluminum enclosure matches metal kitchen and laundry equipment.

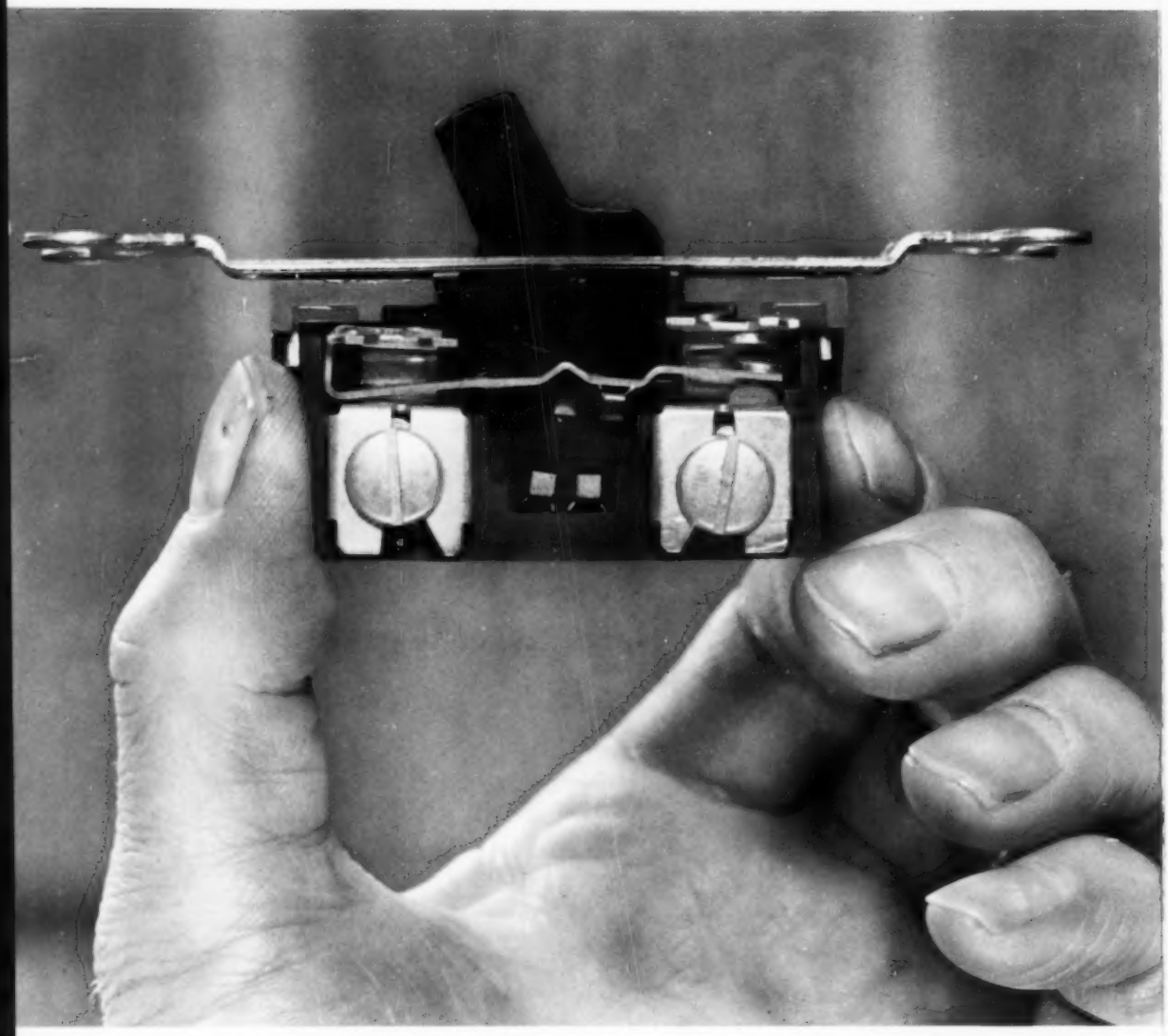


BRYANT MS Master Switch Low-Voltage Multi-Control—can control nine circuits from one point. This system is the most modern method of controlling electrical circuits.



BRYANT RR Relay—this relay actually controls the outlet or lighting circuit.

Open a Bryant switch to see how . .



A-C Switch 4901. Rigid plastic frame seals in the working parts and holds them firmly in line.

Heavy bronze contact arms insure positive pressure.

Silver alloy contacts—the finest electrical conductor known.

Patented neoprene rocker and toggle cam action provide a slow, controlled breaking action yet give maximum closure speed.

Neoprene rocker eliminates metal springs which age and lose tension.

Exceptional quality pays off. We turned this switch on and off one million times before putting it on the market. The one-millionth operation was as positive as the first. This same thoughtful attention to detail is an important reason why you can depend on all Bryant wiring devices for trustworthy performance.

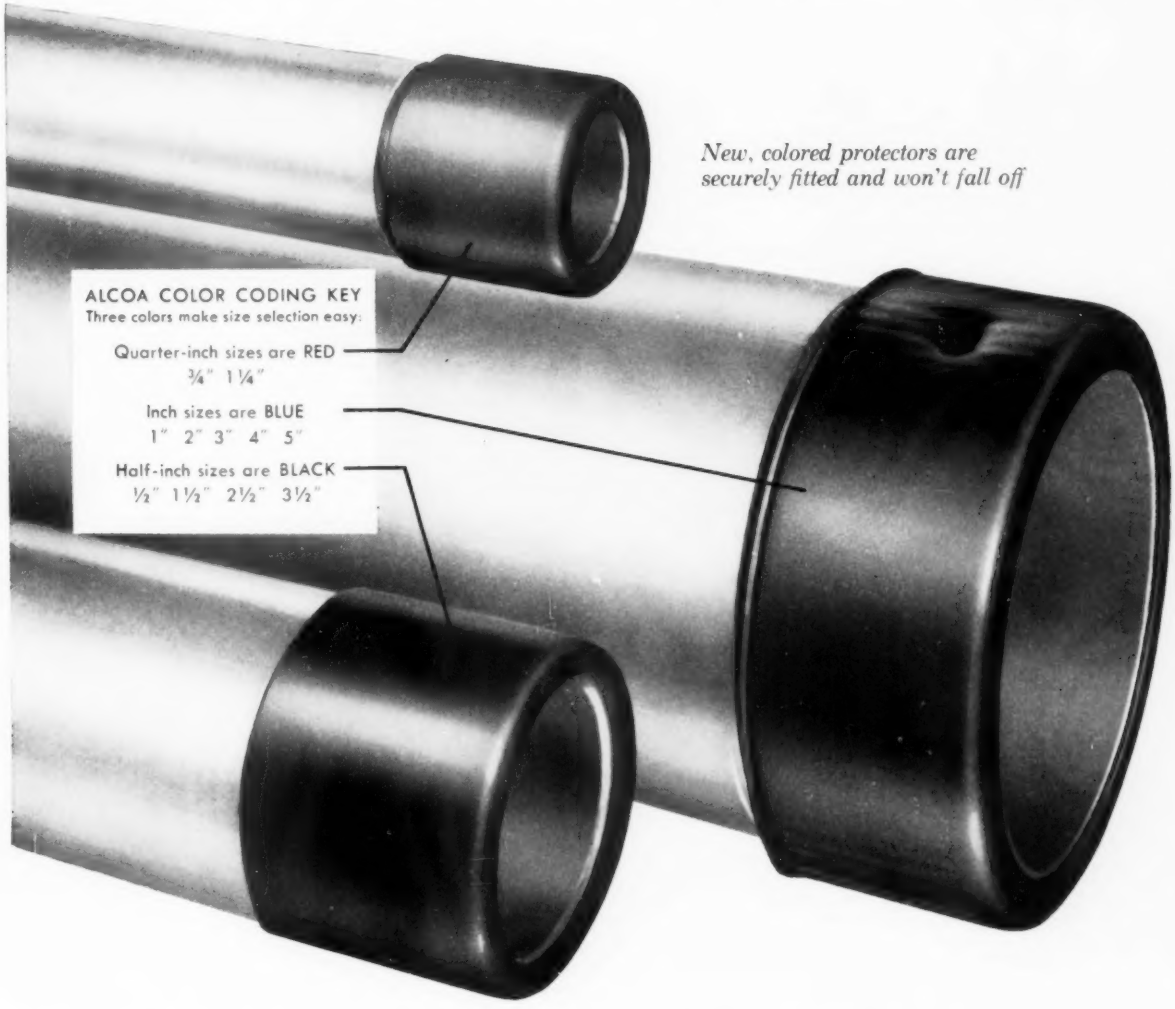
JI-99007

BRYANT

THE BRYANT ELECTRIC COMPANY

BRIDGEPORT 2, CONNECTICUT

NOW! COLOR CODING ON ALCOA RIGID CONDUIT SIMPLIFIES SIZE SELECTION AND STOCKING


ALCOA COLOR CODING KEY
Three colors make size selection easy:
Quarter-inch sizes are RED
¾" 1¼"
Inch sizes are BLUE
1" 2" 3" 4" 5"
Half-inch sizes are BLACK
½" 1½" 2½" 3½"

New, colored protectors are securely fitted and won't fall off

Thread protectors on Alcoa® Aluminum Electrical Rigid Conduit are brightly colored to help you tell size at a glance.

These all-new thread protectors are made to stand up under rough handling in the warehouse or on the job. They spell an end to guesswork and time-consuming mistakes in conduit selection.

With new low prices, Alcoa Aluminum Rigid Conduit is today's most economical buy. Its light weight reduces installation costs. It is nonsparking and nonmagnetic. Excellent corrosion resistance eliminates painting, reduces maintenance and extends life. Find out why Alcoa Aluminum is *your* best conduit buy. Contact your Alcoa Conduit distributor or write Aluminum Company of America, 2327-F Alcoa Building, Pittsburgh 19, Pa.

ALCOA ALUMINUM CONDUIT
ALUMINUM COMPANY OF AMERICA

Underwriters' Laboratories, Inc. INSPECTED
RIGID CONDUIT
ISSUE MU-28

Your Guide to the Best in Aluminum Value

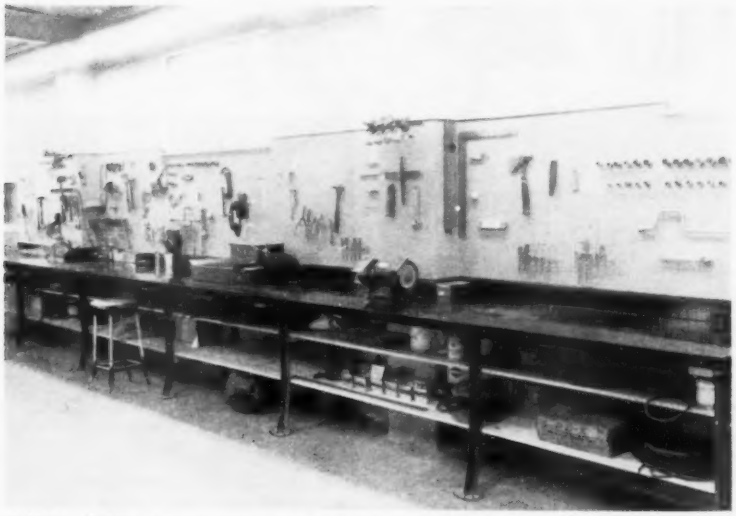
"ALCOA THEATRE"
Exciting Adventure
ALTERNATE MONDAY EVENINGS

Pegboard Provides For Tool Storage

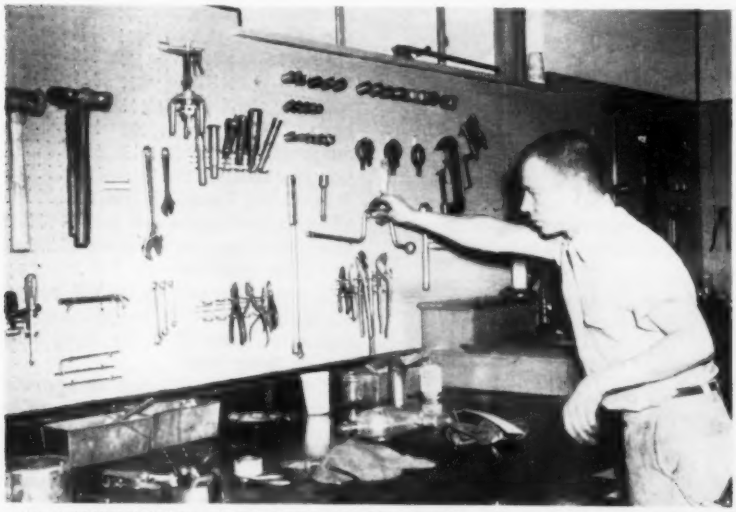
The old adage of "a place for everything and everything in its place" is a good one to practice in a motor shop, where time can be saved by always knowing where to reach for a required tool, and where mislaid tools can be promptly detected and located before they permanently disappear. For that reason, many shop owners have devised various types of tool racks, with clips, shelves, painted outlines and the like intended to further this aim.

Pegboards are especially good for this purpose, since clips and brackets can be quickly added or shifted as requirements for storage change or as new tools are purchased. Also, since holes are predrilled in exact rows and the surface of the board has a hard-gloss finish, tools are stored in precise lines and boards may be either painted or left in their natural stage, as desired. In either case the result is neat, efficient looking, functional and conducive to overall efficiency.

Pegboard is used extensively by the Electric Motor Service of Kennett Square, Pa. And, as the accompanying illustration shows, tools and small parts are always within reach and kept free from bench-top grime. Since a wide variety of bent-bar hangers and racks are commercially available, there is no need to employ make-shift arrangements to obtain these advantages.



WALL AREA above metal bench in this repair shop is covered by pattern-perforated pegboard that provides countless possibilities for inserting bent-bar hangers and racks for the support of tools and small parts. Sections of pegboard encasing columns reflect general attention to detail and quality workmanship.



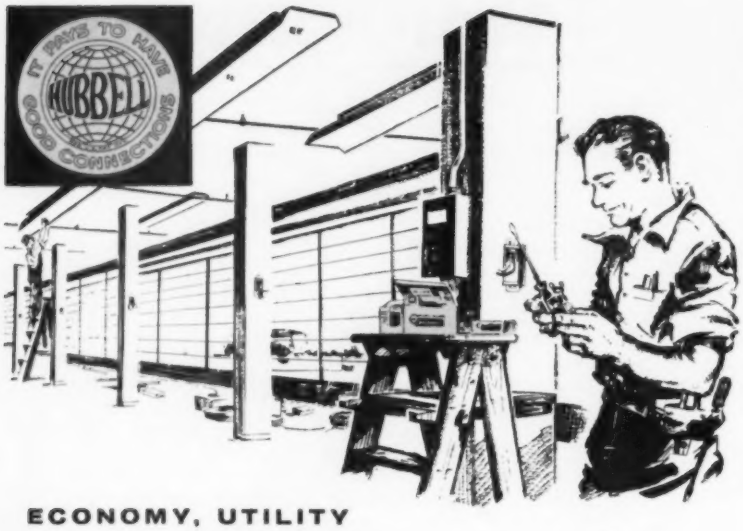
WIDE ASSORTMENT of bent-bar supporting mediums may be obtained, thereby permitting each object or tool to be supported by the best possible means. As assortment of tools increases or as functional areas along the working area are shifted, clips and tools may likewise be shifted to keep the overall arrangement constantly functional.

Motorized Ferris-Wheel Stores and Pays Out Variety of Magnet Wire

Shuffling and moving reels of magnet wire to wind a specific set of stator coils is frequently a time-consuming chore in the motor repair shop. Many shops have devised numerous ingenious techniques to cut this "set-up" to a minimum. At Lansing Electric Motors, Lansing, Mich., you merely push a button and up comes the desired reel ready for threading the wire through a tension device and on to the winding head. No reel wrestling. No storage problem.

Under the direction of Fred N. Selby, Lansing Motors partner in charge of the motor repair department, shop mechanics built a motorized ferris-wheel that permanently stores and positions up to 20 reels of different size wire. The complete unit, handling up to 2,000 pounds of wire, takes up less than 15 sq ft of floor space.

Magnet wire reels are stored for immediate use on a rotating decagonal "wheel" constructed of heavy steel channel. Ten spokes, each a 24-in. length of 4-in. steel channel, are welded to a central hub and form the supports for the reels. The spokes are rigidly positioned and braced by periphery brackets of 3-in. inverted channel welded to the spoke webs about 2 in. from the outer ends. This 2-in. extension of each spoke provides anchorage for 2-ft lengths of 1-in. diameter steel pin which slide through holes drilled in the sides of the spoke channel. Pins are centered by two



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now,— and for the life of the building!

presSwitch

CAT. NO. **1251-I**
15 amps., 120-277 volts
Single pole A.C. "PRESSWITCH" with thru-connection

It's time for the switches... and "Presswitch" is your choice for smooth, dependable fluorescent lighting control. From the installation word "go", throughout the life of the building, "Presswitch" is ***"quality you can put your finger on".***

"Presswitch" saves installation time, labor and materials. A thru-connection eliminates the usual ground wire splice and the time-consuming cost of taping the splice or inserting a wire nut. Wires normally spliced are securely joined by inserting them under a screw terminal designed for the purpose. (See photo at right.)

Once installed, "Presswitch" looks as smooth as it acts. It's "on" or "off" with the slightest press of the finger or touch of the elbow, providing greater operating convenience wherever it is installed.

Ask for "Presswitch" in single pole, double pole, three-way and four-way, with ivorine or brown nylon button. It operates in any position, fits standard boxes, utilizes standard wall plates.

For Complete Information, Write

SAFE, SECURE
THRU-CONNECTION
SPEEDS AND SIMPLIFIES WIRING, SAVES MATERIALS

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WIRING DEVICES • MACHINE SCREWS

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WIRING DEVICE OFFICE AND WAREHOUSE LOCATIONS

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103 North Santa Fe Avenue

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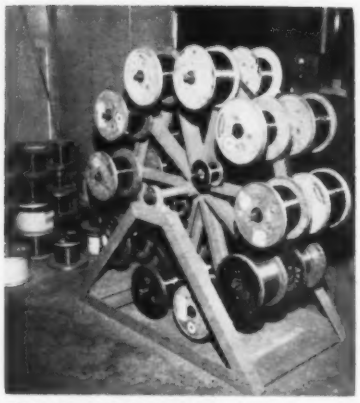
Scarborough, Ontario
1160 Birchmount Road



CHAIN-DRIVEN WHEEL holds up to 20 18-in. magnet wire reels; positions reels for payout to winding head; requires less than 15 sq ft of floor space. 24-in. reels can be added by removing alternate reel pins.

POWER UNIT to turn wheel consists of ¼ hp, 110-volt motor with V-belt and worm-gear drive. Control combines pressure-contact button and reversing toggle switch.

set-screw collars positioned against the sides of the channel. Each pin supports two 12-in. or 18-in. diameter reels held in position by washers and cotter pins at the ends. 24-in. reels can be accommodated by pulling the pins on alternate spokes.

A 2-in. diameter shaft at the wheel hub rotates in a set of pillow block bearings mounted on A-frame pedestals constructed of 3-in. channel iron. The two pedestals have a 60-in. base, a 31-in. height, and are separated some 26 in. by rigid bracing at floor level.

The wheel is rotated at approximately $\frac{5}{8}$ revolution per minute by a roller-chain drive powered by a $\frac{1}{4}$ hp, 110-volt, single-phase, 1725 rpm electric motor mounted near the base of the A-frame pedestal. Through a V-belt connection (about 5 to 1 ratio), the motor drives a worm and pinion gear arrangement which turns a sprocket

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BRINGS YOU

152 different type units

IN ONE FLUORESCENT SERIES

Architects, engineers, and designers can command more than 152 different type units in this new LPI Versataire Series. Versataire offers unlimited possibilities to satisfy most all design and engineering demands and illumination benefits. Whenever you specify or consider fluorescent lighting be sure to consider the versatility of Versataire.

- **direct or direct-Indirect**
- **for 2 and 4 lamps**
- **in 4 and 8 foot lengths**
- **with solid and luminous sides**
- **with 6 different diffusers**
- **12" - 18" - 24" wide**
- **for close-ceiling or pendant mounting**

6 different diffusers

Ventrolens

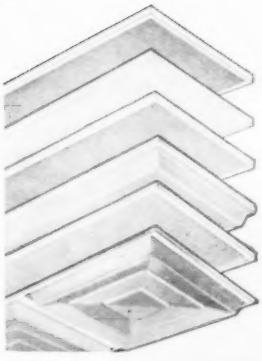
Polystyrene

#70 Corning Glass

Formed Acrylic

#93 Alba Lite Glass

Pattern Vinyl



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ARCHITECT: Emery Roth & Sons
ELECTRICAL ENGINEER:
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ELECTRICAL CONTRACTOR:
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EXTREME CARE: Every facet of these magnificent buildings has been planned with superb attention to detail. Financing, architecture and construction are the best. For this reason — this devotion to excellence — LEVITON 5000 line specification grade electrical wiring devices were chosen. Look for the 5000 number, your assurance of top quality, easy installation, long and dependable service. Send for catalog.
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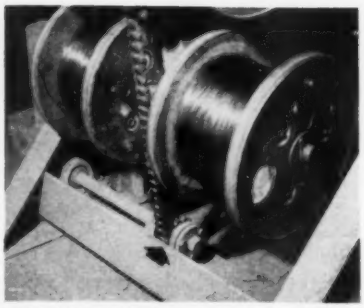
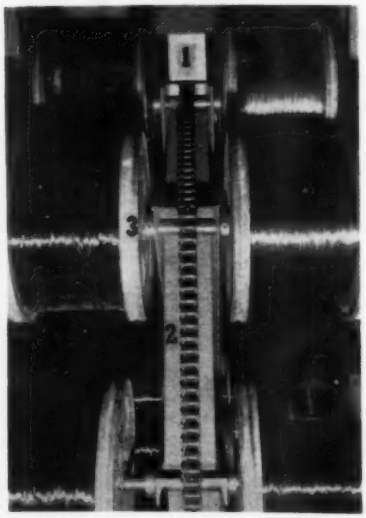


DRIVING CHAIN passes over sprocket (arrow) at base of A-frame. Endless roller chain encircles periphery of wheel supporting magnet wire reels.



TEETH CUT in extension of channel-iron spokes (1) seat and engage the roller chain (2) which rotates the wheel. Note set-screw collars (3) on removable pins for wire reels.

centered under the wheel. The sprocket engages a 1-in. wide roller chain which encircles the wheel periphery. Single teeth cut in the web of the channel iron spokes engage and seat the driving chain. The details of this arrangement are shown in the photo immediately above. Reference to the other photos clarifies the detailed description given here in the text.

Motor control is provided by a reversing toggle switch (to rotate wheel clockwise or counterclockwise) and a pressure type pushbutton. When pressure is maintained on the button, the motor operates; when pressure is released, the motor stops. Thus, the wheel can be rotated until the desired magnet wire reels are correctly positioned for pay-out to the winding head. The exceptionally slow rotational speed of the wheel prevents overriding reel position due to centrifugal force, and no supplementary braking is necessary.

THAT'S WHY PITTSBURGH STANDARD'S HOT-DIP GALVANIZED THREADS SAVE YOU MONEY

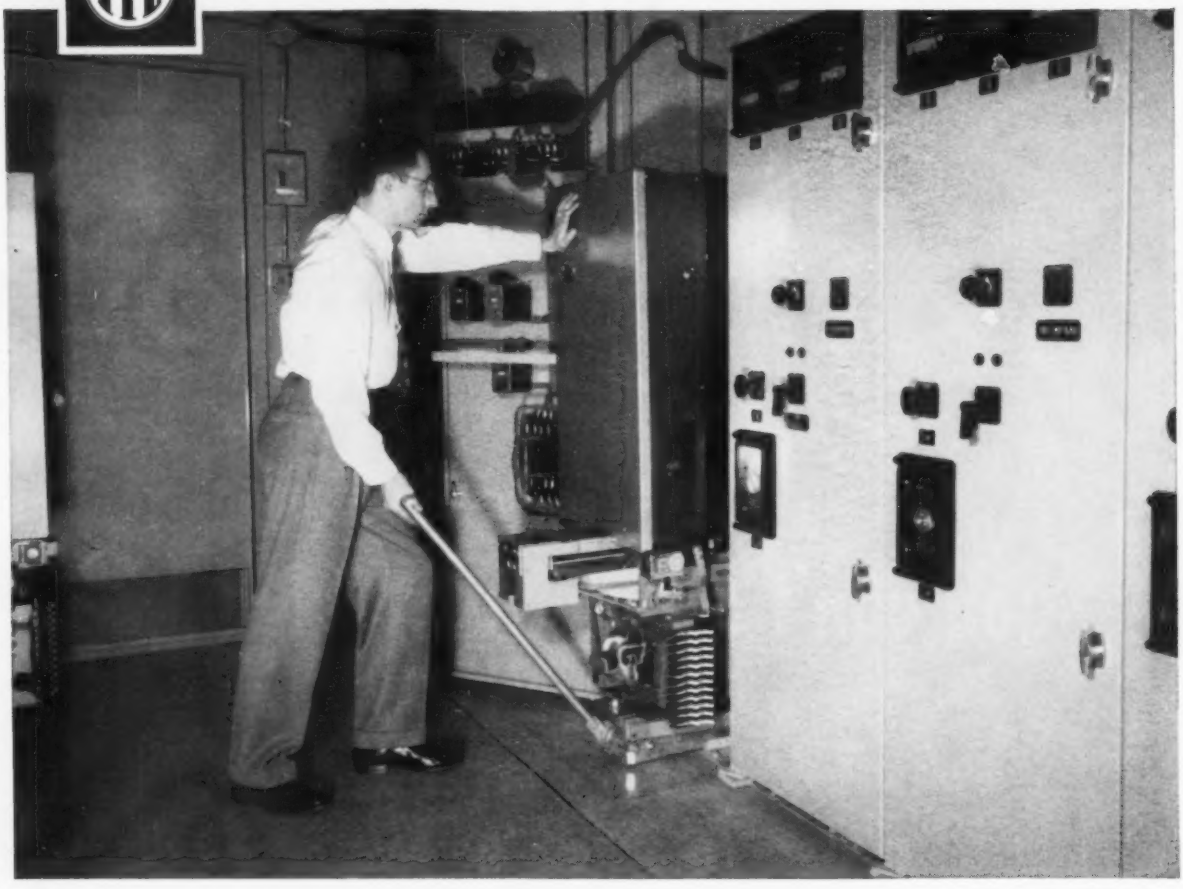
The cost of labor must be figured into the original cost of conduit if you have to pay workmen to chase conduit threads which have rusted in your storage. That's why Pittsburgh Standard's Hot-Dip Galvanized Conduit with *hot-dip galvanized threads* is the least expensive conduit . . . threads just can't get rusty. This happy result is made possible by the world's most modern conduit mill, Pittsburgh Standard's Morrisville plant. The process developed at Morrisville has now been extended to cover Etna production on all sizes through 6 inches. You can get shipping and price information by writing or calling your nearest Pittsburgh Standard wholesaler or *Pittsburgh Standard Conduit Co., 61 Bridge Street, Pittsburgh 23, Pa.*

PITTSBURGH STANDARD CONDUIT CO.

PLANTS AT MORRISVILLE & ETNA, PA.

RIGID STEEL CONDUIT • ELECTRICAL METALLIC TUBING • ELBOWS • COUPLINGS • FITTINGS

METAL-CLAD SWITCHGEAR



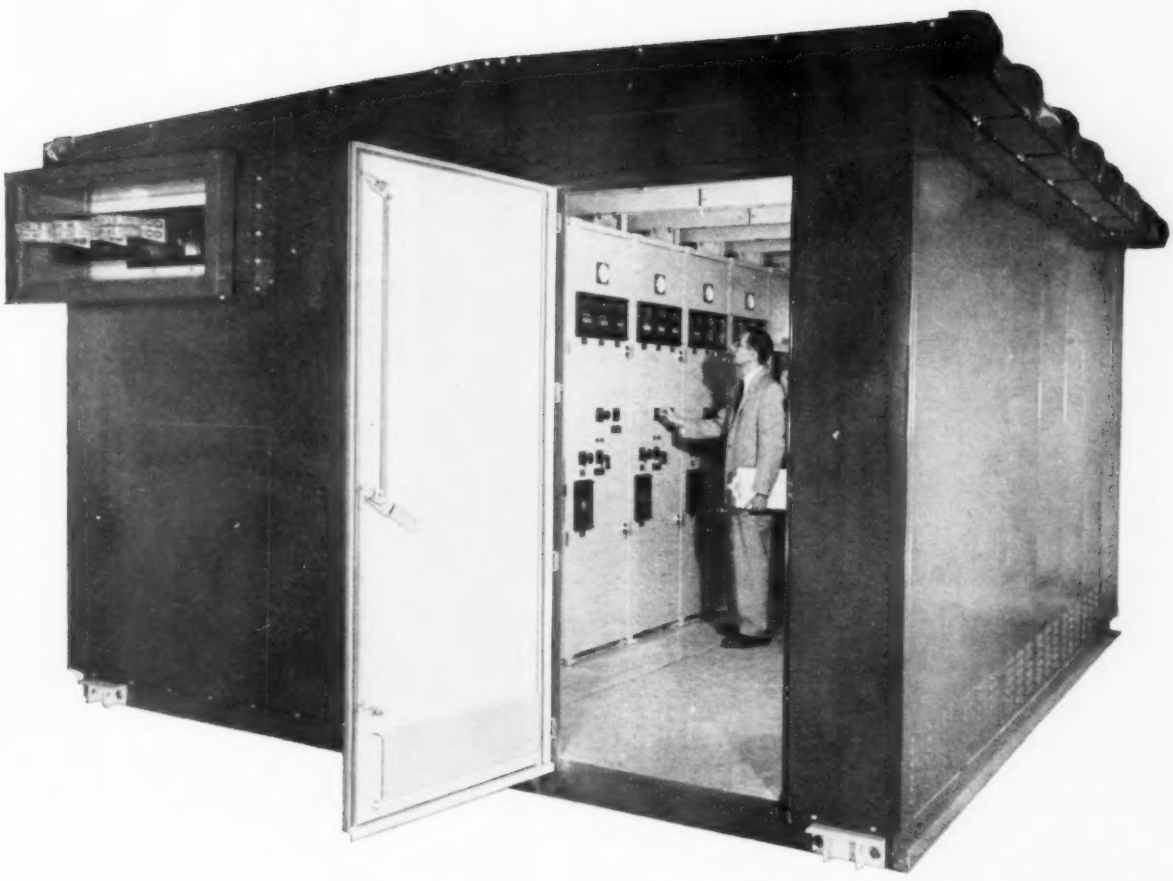
Walk-In Outdoor Shelters Now Being Installed

Hinged rear doors afford easy access to rear of switchgear.

Now available are I-T-E Walk-In Shelters for housing metal-clad switchgear in outdoor locations. These are being produced to meet a growing demand, and already two installations of this I-T-E development are in progress. They render the big service of permitting personnel to maintain switchgear in defiance of weather. These I-T-E Walk-In Shelters feature all the following advantages:

- **Completely gasketed doors, side sheets and frames. Doors are sealed with cellular neoprene sponge; side sheets and frames are sealed with wool felt, impregnated with chromite.**

- **All parts are treated for rust resistance, painted and baked prior to assembly. This protects the metal against rust and corrosion. Further, the bottom of the entire unit is undercoated.**



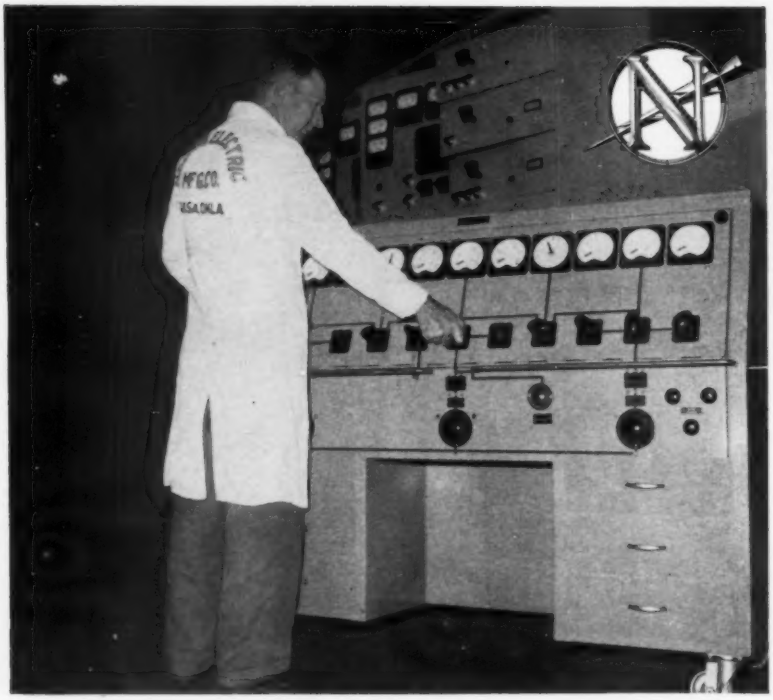
to Protect Service Personnel Against Weather

- **The shelter is completely self-sustaining. It is equipped with ventilating louvers, lights, heating units and convenience outlets.**
- **The entire structure is strong enough to be pier mounted, if desired, with resulting increased savings.**
- **Hinged rear doors afford easy access to rear of switchgear.**
- **Transformer connections can be made through weatherproofed throats, roof bushings, or underground cable, as required.**
- **Space is provided for storing grounding devices or spare circuit breakers.**
- **Nonskid flooring insures safe footing for operating personnel.**
- **Standard shelters are available for any size switchgear assembly.**

For complete information about I-T-E Walk-In Shelters for switchgear, contact your nearest I-T-E sales office or write Switchgear Division, I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada: Eastern Power Devices Ltd., Port Credit, Ont.

I-T-E CIRCUIT BREAKER COMPANY

PHILADELPHIA, PENNSYLVANIA



NELSON SWITCHBOARD TESTING ASSURES PERFECT OPERATION

Nelson makes certain at the factory that your switchboards and switchgear will work right. This quality control is now possible because the . . .

NEW NELSON SWITCHBOARD TESTER DUPLICATES FIELD OPERATING CONDITIONS

Developed by Nelson to test metering and relaying circuits of completed switchgear before shipment, this device tests potential and current circuits.

The performance of the switchboard is accurately measured. Gone is the guesswork of the old-fashioned continuity tests that showed only whether or not the switchgear was wired as shown on the wiring diagram.

This test gives both Nelson and the customer the satisfaction of KNOWING that the equipment is *right* as it leaves Nelson's plant, and is going to function in the field when properly installed.

a major source of electrical control equipment for industry

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

PNEUMATIC HAMMER is effectively lightened in weight by means of rope running to overhead pulley and down to small counterweight. Wood blocks prevent stator from shifting in position while coils are being cut prior to stripping.

Counterbalance and Brace Simplify Coil Cutting

Cutting coil ends prior to stripping stator coils is facilitated by a counterweighted pneumatic hammer and a right-angular wood-block bracing arrangement in the shop of Lange Electric, Baltimore. As pictured, the wood blocks are of 4-by-6 stock, are surfaced with steel plates and are secured at right angles to the top of the stripping bench. Rotors are merely placed on the table, shoved into the corner pocket formed by the blocks, and are held in position by the action of the chisel-holding hammer. The hammer, in turn, is effectively lightened by means of a rope, overhead pulley and counterweight arrangement, an arrangement that lessens the apparent weight of the tool and thereby facilitates the ease of handling.

IDENTIFYING link-chain couplings with their respective bore diameters provides readily-spotted visual assistance and thereby facilitates matching them when needed at a later date. The practice is one followed by the Electric Equipment Co. of Bridgeport, Conn.

Here's how contractors net:

top profits per job with new Murray "MP" breakers

Finest protection possible... at competitive prices

- Superior branch circuit protection
- Carries full rated load
- No nuisance tripping • No waiting to reset
- Only two switch positions
- Tungsten silver alloy contacts
- Sturdy plug-in design • Safety trip-free handle
- Backed by full line of "MP" load centers

Murray

Jobs go up faster, easier with minimum wiring runs — and no nuisance callbacks afterwards

How come? Because "MP" breakers are fully magnetic and contain absolutely no limiting thermal element. They work strictly on current alone — not heat.

Think of the profit advantages for you! Now you can put up load centers *anywhere* — near steam risers, oil burners, even in kitchens over stoves — *wherever it's most practical for quick, easy wiring with minimum runs.*

That's not all! Fully magnetic breakers have always provided superior branch circuit protection without nuisance tripping. Advantages to you: no unnecessary callbacks, satisfied customers, repeat business — and finally, additional profits.

Best of all, "MP" breakers — backed by a full line of plug-in "MP" load centers — cost no more than ordinary breakers.

So next time you order circuit breakers, ask for new fully magnetic "MP's" — and see what a difference it makes in your operations. Available now at your Murray wholesaler's.

For more information about "MP" breakers, mail coupon today!

Murray Manufacturing Corp., 1250 Atlantic Avenue, Brooklyn 16, N.Y. Dept. EC2

Please rush me: ☐ full information on new "MP" line ☐ new 1958 Murray Catalog.

Name .....

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City ..... State .....

Type of business .....

Put wiring anywhere Safely with

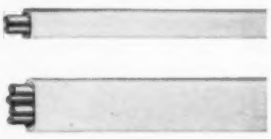
NATIONAL ELECTRIC PRODUCTS — WIRING SYSTEMS — WIRES AND CABLES

SURFACE RACEWAYS

National Electric Surface Raceways make possible safe, fast, economical on-the-surface wiring for commercial, industrial, institutional or residential installations.

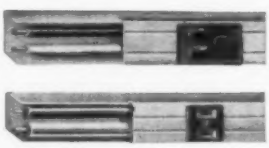
METAL MOLDING

Carries up to 10 conductors. Bends around offsets and columns. Install by simply attaching base, laying in wires and snapping in capping. No fishing necessary.



PLUG-IN STRIP

This prewired raceway is furnished with a spread of outlets every six or 18 inches and a choice of electric services . . . constant, grounded equipment or both constant service and automatic switch control.



BASEDUCT

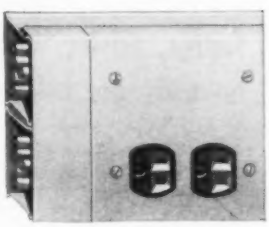
A new easy-to-mount wiring system at the baseboard level. Duplex receptacles provided every 30 or 60 inches in an easily installed wiring harness. Three inches high, baseduct extends ¾" from wall, contains raceway to handle branch circuit requirements.

SURFACEDUCT

A two-piece, all-purpose lay-in raceway for every type of service up to 60 amperes. Device covers accommodate over 300 standard devices—simple fittings for all job requirements.

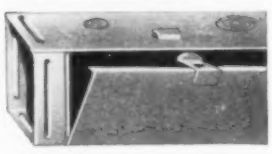
TWINDUCT

A large capacity combination high and low potential electrical raceway for commercial and light industrial applications. Consists of two rows of Surfaceduct with common cover.



WIREWĀ

Hinged-lid wireway with 4" x 4" cross section provides steel protection plus accessibility. Concentric KO's. Available in 6" x 6" cross section. Easy to re-route or extend.



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National Electric Products

PITTSBURGH, PA.

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HIGH CAPACITY SECONDARY SERVICES

[FROM PAGE 85]

10 ft. Our reasons for this recommendation are as follows:

a. It will eliminate confusion as to the proper installation where more than one service disconnecting means (as permitted by Code) are connected to one service take-off.

b. It will establish a possibility of installing the service disconnecting means on a switchboard having proper clearances all around. The ability to locate main service disconnecting means on a switchboard eliminates the creation of a "bus loop" extending down from the take-off to the line side of the disconnecting means and back up from the load side of the disconnecting means and over to the switchboard. The avoidance of this type of installation, which tends to produce heavy induction heating effects, is considered desirable. We believe that the "bus loop" installation will become prevalent under the requirements of Bulletin 11. The alternate installation, namely the running of many parallel conduits under the switchboard room floor, will, in many cases, be unsuitable from the standpoint of the building structure, because of grade slab waterproofing procedures and interference with footings.

7. The Department should consider ground current sensing as a protective measure. This recommendation was made and developed by Leonard Padawer of Cosentini Associates.

The Bulletin correctly reemphasizes the need for low impedance grounding procedures. Line to ground faults, the hazards of which are to be minimized by good grounding procedures, are much more prevalent than bolted 3-phase short circuits. It should also be noted that line to ground faults tend to produce arcing hazards over a much wider area within a building than line to line faults (in which case arcing hazards are confined to the location of the fault). Line to ground faults, especially those of the high impedance ground path type, tend to introduce voltage on all the metallic parts of an electrical system where no voltage is anticipated and where minimum spark gap distances are

[Continued on page 136]

It feels better!

No plastic electrical tape is as TOUGH as SCOTCH No. 33 BRAND

REG. U. S. PAT. OFF.

Super-tough "SCOTCH" Brand No. 33 Electrical Tape is stretchy and puncture resistant . . . yet thin enough to conform easily. Only the genuine "SCOTCH" No. 33—*invented* as a new type of wire splice covering—has "Scotty's" plaid on the can and "No. 33" inside the red core. Ask your distributor about the full line of "SCOTCH" Brand splicing materials, or write us for complete information.

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The price per splice is less . . . Let us prove it!

MINNESOTA MINING AND MANUFACTURING CO.
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Don't just tell me . . . *show* me that the price per splice is less with "SCOTCH" No. 33. Send a man around.

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. . . WHERE RESEARCH IS THE KEY TO TOMORROW

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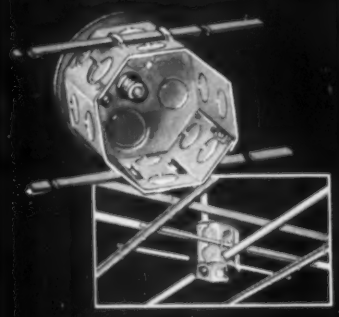
HUNG CEILING BOX

— for Dropped Ceiling Construction



— *with these top features:*

- New extruded slots for supporting bars.
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Feature by feature, this is the most versatile hung ceiling box available . . . and the easiest to install.

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HIGH CAPACITY SECONDARY SERVICES

[FROM PAGE 134]

not maintained. This greater prevalence and hazard of line to ground faults over line to line faults leads us to believe that any extra protection which can be developed for limiting the hazards of high impedance line to ground faults should be carefully considered since these faults may not draw enough current through the line overcurrent protection device to clear (even when the best grounding procedures are provided).

As a first consideration, we have been investigating the value of providing separate and isolated grounding connections to the grounding electrode for the system neutral, and for the equipment and raceway ground. This type of connection permits the introduction of a ground current sensing relay in the equipment and raceway ground connection. This relay could be utilized to send an alarm, or even open the main service disconnecting means. Since switchboard room temperature alarm and remote control of service disconnecting means are being recommended, these latter ground current protection procedures need in no way become matters of great extra expense.

The question of determining the most advantageous setting of the ground current sensing relay requires testing and averaging ground impedance readings on the equipment and raceway systems in many buildings, with their present ground electrode connection disconnected, and any utility company raceway ground also disconnected. Since our office at present does not have the financial backing necessary to carry on such experimentation, as suggested above, we are hoping that the wide circulation which we are giving to this letter will arouse enough interest among other sources so that further assistance to the Department in this matter will become available.

8. The Department should not permit main fuses ahead of the main disconnecting means in existing buildings.

In the case of existing buildings, the Bulletin permits the installation of main service fuses on the line side of the main disconnecting means to account for conditions where it is impossible to locate the main service equipment at the utility company service terminals. We believe that this represents an unnecessary relaxation of the basic requirements of the Bulletin, which state, that the main fuses should be located on the load side of the main disconnect means. The main fuses when located on the load side of the main disconnect means can be renewed with the supply voltage cut off, and we think that there is no need to abandon this feature in existing buildings. If the main disconnecting means *and* main fuses cannot be located directly at the service stabs, then we feel that concrete encased conduits should be used to extend the service terminals to such a location as is suitable for both the installation of the main service disconnect means and load side fuses.

Solution At Hand

All of the foregoing—the details of Bulletin 11 and the comments of Eitingon & Schlossberg—represents the serious effort being made in New York City to find a sound solution to the problem of high current services. Although no firm decisions have as yet been forthcoming, focus on the details of the problem has been cleared and great progress has been made. A set of clear, definitive regulations and recommendations will soon be enacted. It is to the industry's credit that close cooperation among code authorities, consulting electrical engineers and manufacturers is playing an important role in the development of the final draft of Bulletin 11.

SUPERINTENDENT of the Potter Electrical Engineering and Construction Co., Inc. in Terre Haute, Ind. is Hollis Smith. Mr. Smith is in charge of 35 electricians employed by the firm whose business centers around industrial and commercial work.

Note how ordinary EMT split early in pressure test while induction welded CIRTUBE EMT (shown here unplated) held fast, surpassing UL requirements.

BETTER WELDING

on new CIRTUBE EMT means easier, split-free bending

THERE are many reasons why new CIRTUBE EMT will help you get faster, cleaner wiring jobs. Most of them are listed here.

One *big reason,* however, is *continuous induction welding*—by far the best technique available for making bead-free, split-free welds on high quality EMT.

It is virtually impossible to split an induction-welded EMT no matter how severe the bends. And the perfectly clean weld means uniform roundness—easier, neater bending without the slightest kink or flattening. Your men get it right the first time around.

Try induction-welded new CIRTUBE EMT soon as you can. Your wholesaler has it now—bundled with distinctive orange colored tape to identify the EMT manufactured to Circle's quality standards.

CIRCLE WIRE & CABLE
a subsidiary of CERRO DE PASCO CORPORATION

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** in all principal cities
RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES
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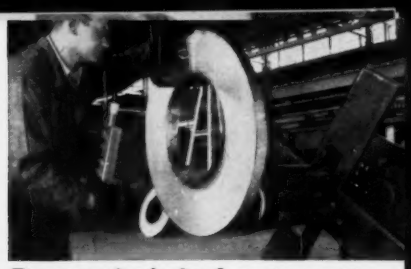
CIRTUBE EMT *Ask for it!*

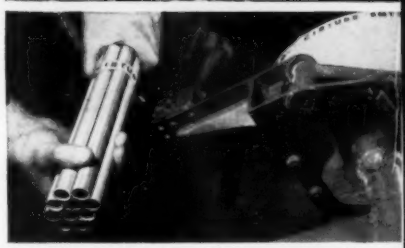


Proper steel plus! The best cold rolled steel plus the right handling give CIRTUBE EMT its natural bendability.

Easy fishing! A baked-on protective coating gives CIRTUBE EMT a built in lubrication for easier wire pulling.

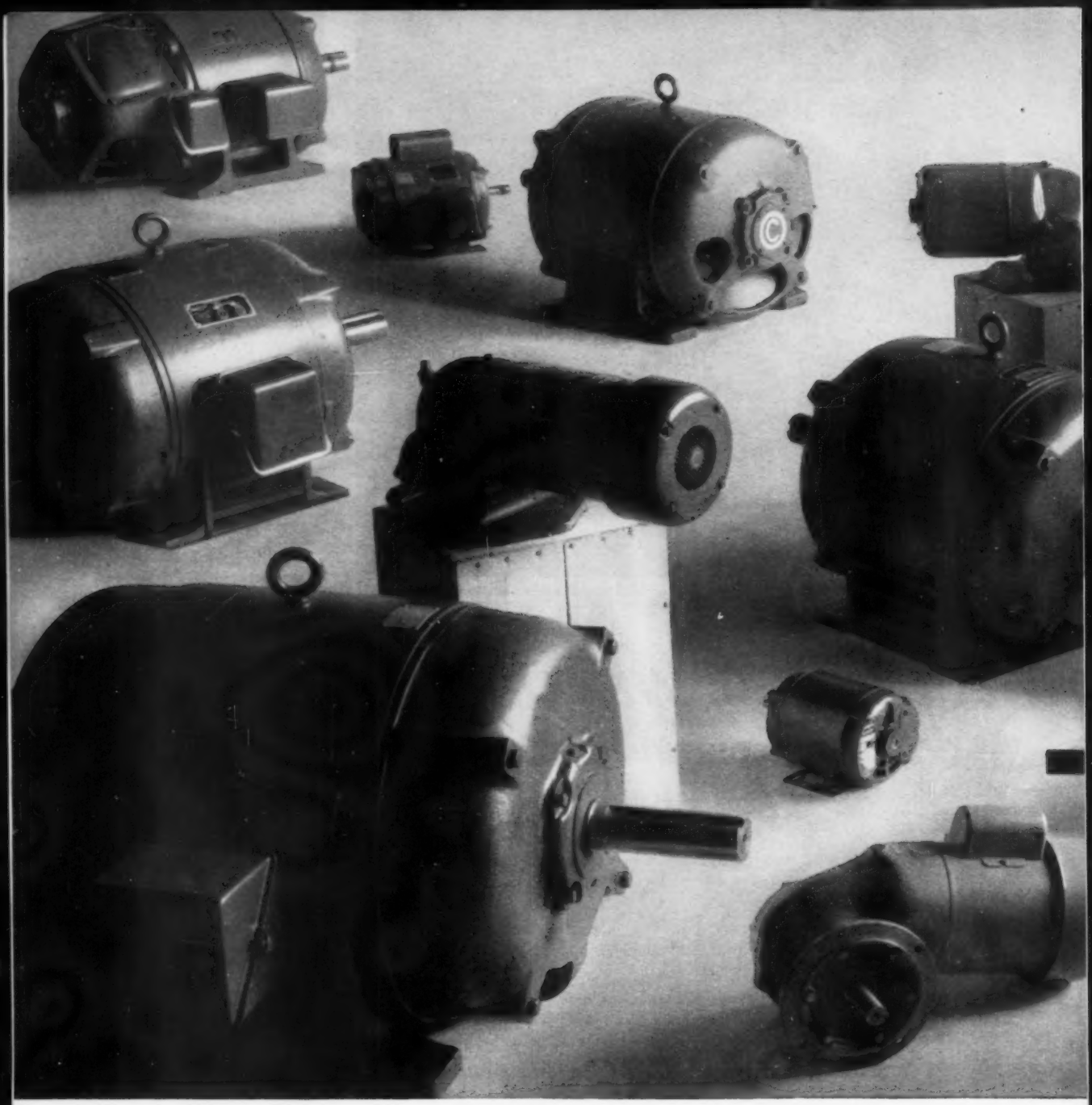
Lifetime exterior finish! Hard galvanized finish for durability; polished satin lustre for lasting good looks.

Automated quality control! Automatic controls assure complete and continuing uniform quality of product.



Tight, easily handled bundles! Bright, orange tapes hold CIRTUBE EMT securely for easy handling on and off the job.

Fast, friendly service! Well-known Circle service through a nation-wide network of well stocked nearby warehouses.



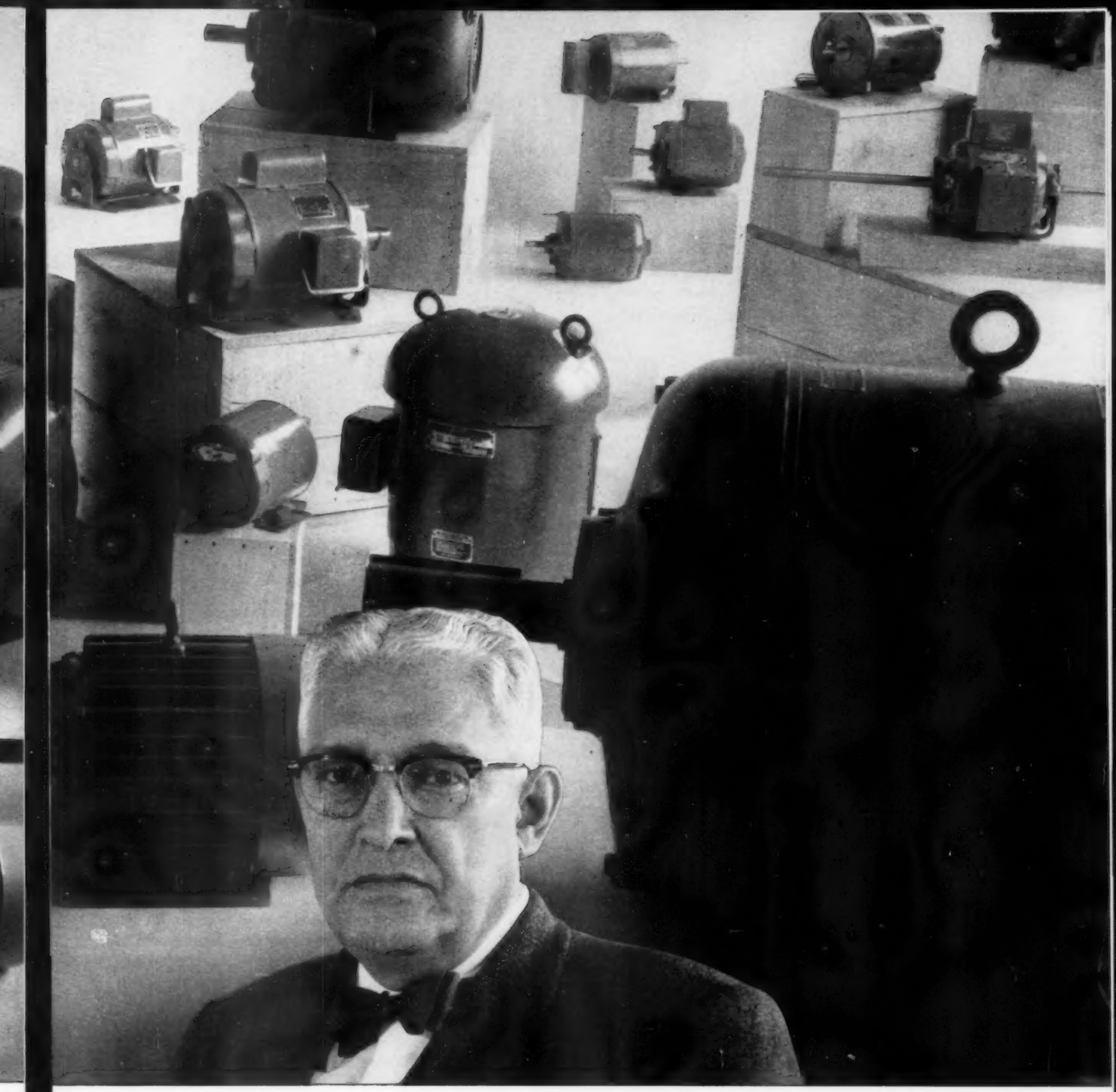
How to give your customer more than a motor

You can solve all motor problems with

You can make your job easier by selling Century Electric motors, 1/20 to 400 hp. Here's how:

Easy ordering—You save time because you can give your customer answers to all his motor problems from one source, and you save him valuable time (and money) because he doesn't have to shop around for motors. He'll appreciate it. When he asks about motors he knows you have the answer.

Fast shipments—From Century Electric's complete stock you can get a motor for any standard application and a quick answer for your customer. In addition, motors are packed in sturdy boxes so when you reship to your customer you know he will get motors in good condition.



Century Electric's line . . . 1/20 to 400 hp

Application know-how—But you want to be sure he has the right motor for the job. And if you need help on this, you get expert back-up from your nearest Century Electric sales engineer. He knows motors inside and out because he sells, applies and thinks nothing but motors day after day.

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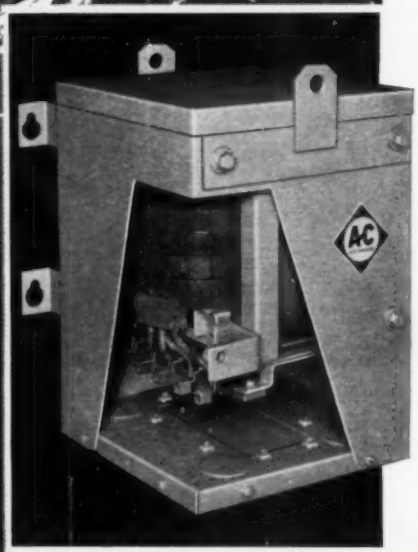
Are Your Transformer Requirements as Tough as the Navy's?



Cutaway model. Transformers are available in single-phase and three-phase designs, ranging from 3 to 75 kva, 600 volts or less.

IT isn't likely that utilities and industrial users subject dry-type transformers to the punishment the U. S. Navy expects its equipment to withstand. Yet, Allis-Chalmers gives you the same, extra-dependable dry-type transformers in "industrial-type" enclosures that the Navy installs in supercarriers, guided-missile destroyers and mine sweepers.

Allis-Chalmers totally enclosed dry-type transformers can save you as much as 20% on initial cost in place of an oil-filled unit. They are more economical to operate and can actually increase production. These units can be located outdoors, they're weatherproof—or indoors in dusty, lint-filled or moist atmospheres. They are quickly and easily mounted on walls, posts or machinery. Maintenance is virtually eliminated because there is no cooling liquid to change or filter — the coil is given maximum protection with high temperature insulating materials consisting of Fiberglas, asbestos based materials and silicone varnish.

For complete information, call your nearby A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-5637

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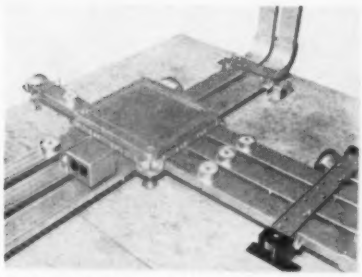
Product News



Color-Coded Underfloor Duct System (1)

A new metal underfloor duct system with color-coded assembly parts and accessories will be available. System features standard duct (1⅜-in. by 3¼-in. OD) and super duct (1⅜-in. by 7¼-in. OD) sections interchangeable in the single and two-level junction boxes. One super duct takes the space of two parallel standard ducts. Available in standard 10-ft and 12-ft lengths which can be cut in half.

Multi-duct junction boxes, for up to five parallel standard ducts or a combination of standard and super ducts, are of galvanized steel with knockouts in bottom, have solid zinc alloy corners and separators which double as cationic electrodes to provide cathodic protection to steel system. Rugged box leveling screws lock in place. Box line includes square or rectangular single and two-level junction boxes assembled from pre-fabricated sides of various configurations. Boxes can be inserted between parallel ducts for supplementary feeds to single-level system or for complete two-level systems.

Adjustable, dual-channel bridge supports double as duct couplers for added strength at duct joints; have removable separators to maintain duct spacing and accommodate combination of duct sizes.

Modular type service fittings of solid aluminum or brass have removable cover and side plates for easy wiring; take up to two duplex receptacles back to back; have provisions for attaching connector blocks, buzzers, wire clamps, etc., for communication systems.

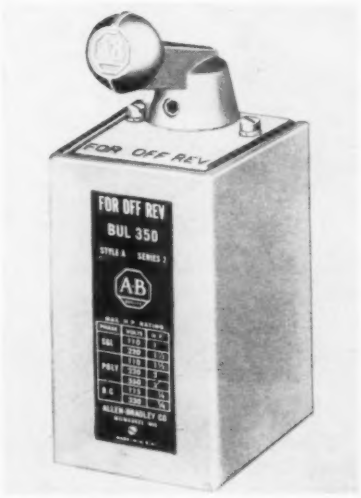
System includes line of cast accessories—cabinet connectors; vertical, offset and horizontal elbows with attached leveling screws; adjustable elbows; and conduit to duct adapters. Literature is available.

Gateway Engineering Company, 3233 West Grand Ave., Chicago 51, Ill.

Ballast (2)

A new low temperature ballast for two 40-watt T12 rapid start fluorescent lamps that will operate at 90°C or below at the hot spot in any modern totally enclosed 4-lamp fixture that is surface mounted on an acoustical tile ceiling. Designated 6G1020, it represents no increase in size, weight or decrease in sound rating over previous models. It permits the same light output possible with former ballasts of the same rating.

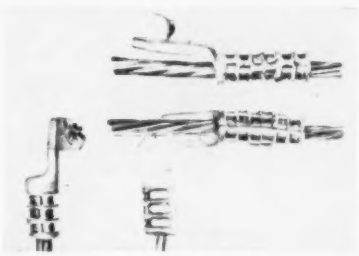
General Electric Co., Schenectady 5, N. Y.



Drum Switch (3)

A drum switch for starting, stopping, and reversing small ac and dc motors. Available in surface-mounted NEMA Type 1 enclosure, or with an oiltight cover plate for cavity mounting in a machine base. It features a newly designed, wrap-around cover which exposes the switch mechanism for easy wiring. Terminal screws are accessible from the front. The edge of the enclosure base is raised so that the wrap-around cover can be slipped off or on directly from the front, when the unit is mounted on its base. Two conduit openings are provided in the base. The Bulletin 350, Series B, drum switch is available for 1½ hp, 110-volt; 2 hp, 220-volt, single phase motors; 2 hp, 110/220/550-volt polyphase motors; and ½ hp, 115-230-volt dc motors.

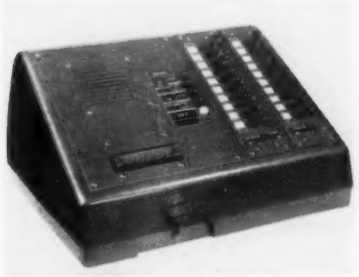
Allen-Bradley Co., 136 W. Greenfield Ave., Milwaukee 4, Wis.



Compression Connector (4)

New compression connector has run and tap on opposite sides of the L-bar so drip from copper run cannot fall on an aluminum tap wire and cause corrosion. "Penn-L-Tap" is hooked over the run and crimped by any standard crimping tool. Tap end is closed with an easily punctured transparent code-colored cap, which need not be removed for inserting the tap or for crimping. Run end is sealed with removable code-colored tape. Usable on all combinations of aluminum-to-copper or aluminum-to-aluminum.

Penn-Union Electric Corp., Erie, Pa.



Communication System (5)

Desk-top unit is the control station of new "SS-300" school sound system. Sound, public address, and 2-way intercom transmissions may be sent out to any combination of classrooms. Provides time signals in conjunction with any standard single channel program clock. Control station, with capacity of up to 20 classroom stations, measures 8 ins. high, 15½ ins. wide, and 12⅜ ins. deep. Soft chime and annunciator light remain on, registering call from a classroom until administrator is free to accept. Special purpose stations for auditorium, gymnasium and corridors, and outdoor locations are available.

Executone, Inc., 415 Lexington Ave., New York 17, N. Y.

Power Center (6)

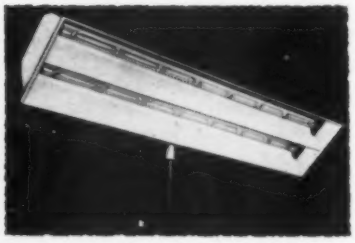
A new line of dry-type power centers, Type DT-3 are available in 5- and 2.5 kv classes for high voltage, and 600, 480, 240 and 120 volts on the low side. Three-phase power ratings are from 45 to 300 kva. The new center uses an air-insulated 3-phase load break switch, Type RLB, with or without fuses. Either top or bottom entrance is possible. The 45-kv BIL switch has a NEMA Class A rating of 600-amp load current for 500 operations, or Class B rating of 600 amp for 100 operations. All controls are on front of unit, including switch handle, fuse and panelboard access doors, and tap changer handle access panel.

Westinghouse Electric Co., Box 2099, Pittsburgh 30, Pa.

Disconnect (7)

200-amp service disconnect now serves two separate 100-amp circuits. Sub-feed lugs have been added to the load side of the 200-amp pullout, both indoor and raintight. Pullout has pressure type connectors at all terminals; two blade, knife type reinforced fuse clips for positive electrical contact.

Murray Manufacturing Corp., 1250 Atlantic Ave., Brooklyn 16, N. Y.



Outdoor Fluorescent (8)

A new porcelain fluorescent floodlight fixture featuring the new Power Groove equipment has been introduced. Construction makes use of 1-piece, 20-gauge steel housing. Removable "V" type reflector fabricated from 20-gauge steel. Both are finished with a ground coat and fired with white porcelain enamel. Available as an open unit for warm climates, also with Plexiglas plastic enclosure for cold climates. Socket plates of heavy-gauge aluminum and the slip pole fitter and adjustable mounting adapter are cast from high-tensile aluminum alloy. Supplied with two F72/PG17 lamps. Ballasts suitable for outdoor applications and efficient starting at low temperatures. Has provisions for cluster light combinations.

Guardian Light Co., 500 North Blvd., Oak Park, Ill.

Aerial Lift (9)

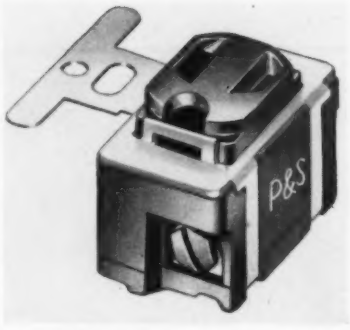
New aerial lift has been designed to do a wide variety of lift functions. The Truco lift is insulated with fiberglass, and designed with counterbalancing, so that a man can ride it safely while the truck is moving. Mounts on the smallest open-type standard service or utility body, and collapses low and short. Controls are at the basket.

Truck Equipment Co., 3961 Walnut St., Denver, Colo.

Service Head (10)

A new clamp type service head is suitable for use on either rigid conduit or EMT with no additional fittings needed. The head is secured to any type of conduit by tightening two screws. Body and cap are cast Feraloy and clamp is ductile aluminum. Head is available in several sizes, for ¾-in. to 1½-in. conduit, all having 5-wire, 5-knockout covers.

Crouse-Hinds Company, Syracuse 1, N. Y.



Grounding Outlet (11)

New interchangeable 1332 Despard 3-wire grounding outlet features screw terminals, parallel slots, and U-shaped grounding terminal with green hex screw. Rated 15 amps, 125 volts, it will take all 125-volt 3-wire grounding caps as well as standard polarized or nonpolarized parallel blade caps. Outlet must be installed in the end opening of the 1348 Despard cam-strap; outlet grounding strap fits under the 1348 mounting strap, grounding the device to the box. Catalog is available.

Pass & Seymour, Inc., Solvay Station, Syracuse 9, N. Y.

Master Switch (12)

A small-size vertical master switch for heavy-duty applications has been developed. Offered in four sizes to accommodate maximum of 4, 9, 12, and 16 circuits, the new VM master switch is supplied for either right or left-hand operation. Available with or without enclosure. Designed with mill-type construction throughout, for any desk-mounted mill or crane application where space is limited. Optional features include spring return to off point and pushbutton contact in handle.

Electric Controller & Mfg. Co., Div. of Square D, Cleveland 28, Ohio.

Westinghouse electrical system specified to Power-Up Ford products plant

YOU CAN BE SURE...IF IT'S Westinghouse

COVER PHOTO: Assembled in the plant layout room of the Ford Motor Co., General Products Division Plant, Indianapolis, Ind., are: Melvin Wetterlin, Westinghouse Sales Engineer, J. Vance Garinger, Project Engineer, Hatfield Electric Co., Inc., Electrical Contractors; S. V. Cornforth, Maintenance Engineer, Plant Engineering Department, Ford, Indianapolis; D. A. Kerry, Supervisor, Ford General Products Division Staff, Dearborn, Michigan; H. P. Jones, Manager, Plant Engineering Department, Ford, Indianapolis; James Miller, Westinghouse Construction Sales Engineer; and R. Richards, Supervisor, Engineering Planning, Plant Engineering Department, Ford, Indianapolis.

Melvin Wetterlin, J. Vance Garinger, and J. Rodriquez, Power and Waste Supervisor, Plant Engineering Department, Ford, Indianapolis, look overhead to identify the Westinghouse 45-kva DT-3 dry-type transformer, Westinghouse aluminum bus duct and Westinghouse fluorescent and high-bay lighting. Westinghouse NLAB-LX column-type panelboard, shown with trough and pullbox, is fed from the secondary of the dry-type transformer above.

Main entrance to Steering Gear and Cold Heading Plant, General Products Division, Ford Motor Company, Indianapolis, Indiana. Westinghouse electrical distribution system is used to meet present electrical needs, provide the necessary flexibility to permit extensive rearrangement of production machinery whenever required and to assure maximum facility in expanding to satisfy all future demands.

J-94104-2

Ford plant planning anticipates future power needs

The Ford Motor Company plant in Indianapolis, Indiana, where these pictures were taken, occupies more than 1,400,000 square feet of floor area. It requires a constant power supply of 26,500-kva. The combination of great size, large capacity and exacting, but frequently varying, production schedules makes it imperative that plant engineering must go beyond careful control of everyday operation. Planning for future demands becomes equally important.

Westinghouse, working with architects, consulting engineers, general contractors, electrical contractors and Ford engineers, had an active part in equipping this plant with the electrical distribution system and with other electrical components required to assure uninterrupted operation and provide for anticipated expansion. For example, 144 Westinghouse dry-type transformers of various ratings are mounted at heights varying from 22 to 45 feet above floor level, above conveyor trusses. The light weight, ease of installation and minimum maintenance requirements of these dry-type transformers have made it possible to locate them so each provides the required voltage, with minimum loss, to the equipment it supplies.

Over 6000 Westinghouse high-bay mercury vapor fixtures give daylight-type lighting in production areas, and these are supplemented by Westinghouse fluorescent lighting for the general illumination required by nighttime clean-up workers.

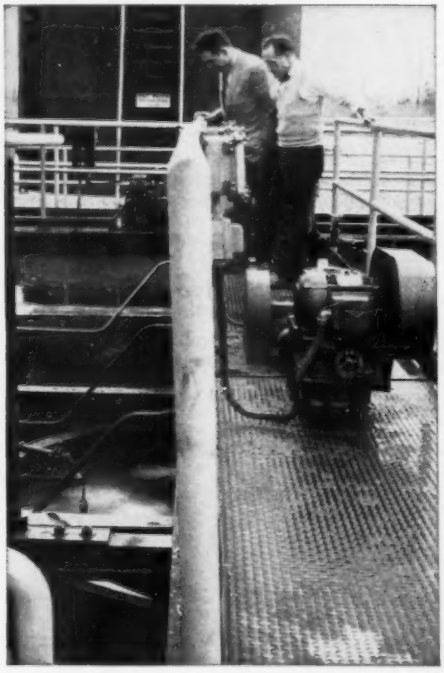
Approximately 2½ miles of Westinghouse 600-amp, 480-v, 3-pole, aluminum plug-in bus duct, mounted in 17 parallel straight runs (shown as

(continued)

J-94104-3

YOU CAN BE SURE...IF IT'S **Westinghouse**

J. Rodriquez checks substation meter to make certain power factor constant at 98% lag is being maintained throughout the plant. This extreme efficiency of the electrical system is made possible by the use of Westinghouse capacitors.



J. Rodriquez and W. D. Eason, Engineer, Waste Treatment Plant, Plant Engineering Department, stand beside Westinghouse 7.5-hp totally enclosed Life-Line® "A" motor which drives the waste oil recovery tank agitator.

Shown between Lloyd L. Williams, Branch Mgr., WESCO, Indianapolis, and Paul E. Butalla, Main. Supvr., Plant Engin. Dept., Ford, Indianapolis, is Westinghouse Slipsyn® synchronous motor starter providing automatic starting and field application control for Westinghouse 400-hp, 440-volt motor.

J. Vance Garinger, Lloyd Williams, C. E. Hamm, Sales Rep., WESCO, Indianapolis, and J. Rodriquez shown before one of the nine power centers which distribute the 26,500-kva oad throughout the plant. Power centers have stand-by circuit breakers and blank cubicles equipped for future needs.

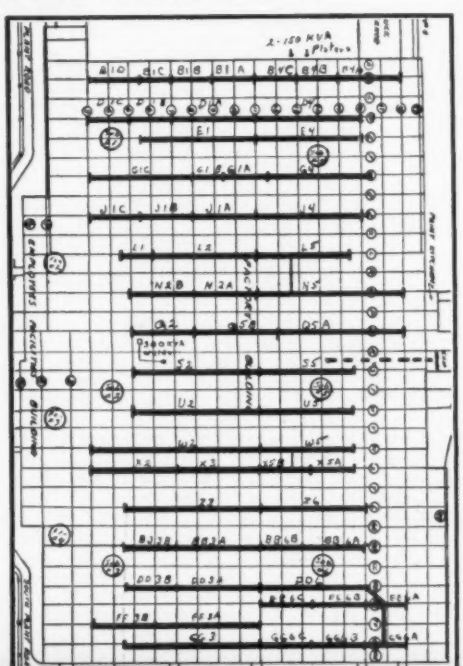
Ford plant planning anticipates future needs *(continued)*

heavy black lines in diagram), have been installed to provide maximum flexibility in locating production machinery.

Westinghouse can help you with any phase of your electrical planning and construction. See your Westinghouse distributor, or write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

Ford Motor Company
Steering Gear and Cold Heading Plant
General Products Division
Indianapolis, Indiana

Architect-Engineers: Smith, Hinchman and Grylls Associates, Inc.
Consulting Engineers: (Waste Treatment Plant) Hubbell, Roth & Clark, Inc.
General Contractors: Cunningham-Limp Co., Inc.
Electrical Contractors: Hatfield Electric Co., Inc.
Westinghouse Distributor: Westinghouse Electric Supply Co., Indianapolis, Indiana



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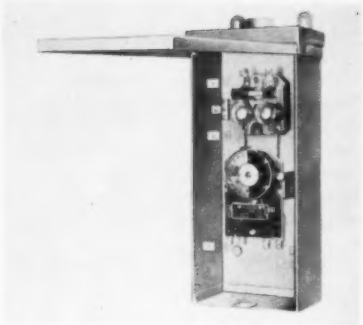
Over 250 Pages Westinghouse Data in Sweet's Construction File (S)

J-94104-4



Sign Control (13)

A single-package control for poster lighting, Model No. 5100, contains a service switch, fuses, and time switch, all prewired and in a rain-tight enclosure. It is designed to conform with local code requirements, and meets requirements for raintight service entrance equipment. Lug terminals take up to No. 6 wire. An extra heavy-duty timing motor on the time switch is used. For selection of time control, two dial styles are available, either standard 24-hour dial or astronomic dial. Available in single- or double-pole models.

Tork Time Controls, Inc., Mount Vernon, N. Y.

Luminous Ceiling (14)

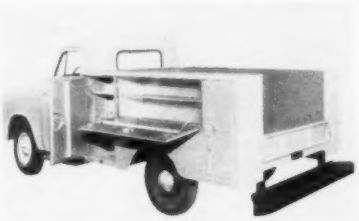
New packaged luminous ceiling named, "Sunshine Ceiling", measures 6 by 4 ft, designed for use in 5- by 7-ft and 5- by 8-ft bathrooms and the smaller kitchens. Unit features two component parts, an electrical system enclosed in metal channels and a metal grid which holds six 2- by 2-ft plastic diffusers. Metal channels enclosing the electrical system are fastened directly to the ceiling. The grid with its plastic diffusers, is suspended 8½ ins. from the channels. Uses six 100-watt incandescent lamps; pastel Coloramic lamps create unusual lighting effect.

John C. Virden Co., 6103 Longfellow Ave., Cleveland 3, Ohio.

Aluminum Cable Trough (15)

Cable trough is now offered in expanded aluminum to supplement expanded galvanized steel cable supports. Includes a wide range of standard fittings. Offers resistance to many corrosive atmospheres. Solid sides for greater strength. Sections are secured by flat pins driven between interlocking barrels. Available in widths of 6, 9, 12, 18, and 24 ins. and in 8-, 10-, and 12-ft lengths.

T. J. Cope Div. Rome Cable Corp., Collegeville, Pa.



Service Truck Body (16)

New Model 900C service truck body has many improvements. Paddle locks on all doors are serviceable in the field using only pliers; one-hand operation with safety-type catch prevents a partly-closed door from opening accidentally. To facilitate collision repairs and replacement in the field, a bolted, sectional construction has been adapted. Components such as side boxes, bulkheads and floor are bolted for easy "knockdown". Compartments are all newly sized to take standardized packaging units; shelves are adjustable. Full-length tool trays with reinforced rolled edges. Adjustable dividers for standard small-parts packaging.

Service Body Div., Morrison Steel Prod., Inc., 601 Amherst St., Buffalo, N. Y.

Generators (17)

Two new 3,000 watt, gasoline-engine-driven generators specifically designed for use by contractors, builders, plumbers, and electricians. The 115-volt, 60-cycle Model 8A115 and the 115/230-volt, 60-cycle Model 8A115/230, provide a dependable source of power for operating floodlights and power tools on the construction site. Weighing 140 lbs, these generators can be carried easily and used anywhere on the job. 2-cycle gasoline engine is directly coupled to the armature shaft.

Homelite, Port Chester, N. Y.

Lighting Unit (18)

An outdoor lighting unit accommodating from one to three high to very high output fluorescent lamps has been developed in 6- and 8-ft lengths for 60 cycle and higher frequency supply. Consisting of ¼-in. extruded aluminum body plate, a "unitized" aluminum housing assembly and extruded acrylic plastic shielding assembly, this unit is waterproof, dust-tight and treated for corrosion resistance. Various raceway assemblies attached to the body plate are available with separations for different wiring systems. They can be surface or recessed mounted. These units are for pedestrian and vehicular underpasses and tunnels, airport aprons, loading docks and other outdoor areas.

Globe Lighting Products, Inc., 2121 South Main St., Los Angeles 7, Calif.

Rod Hanger Clamp (19)

New "Gat" rod hanger is a pressed metal clamp with integral gripping teeth, formed in one piece from high-carbon, heat-treated steel. It can be used to hang plumbing, heating, and electrical equipment by means of rods or straps. Clamps are first driven onto the ends of the hanger rods with one or two hammer blows and then hammered into place on the lower flange of the bar joist or other structural support.

Geo. A. Tinnerman Corp., 19922 Ingersoll Drive, Cleveland 16, Ohio.

Air Circuit Breaker (20)

A new metal-clad switchgear unit with a 13.8-kv magnetic air circuit breaker of 1000-mva interrupting capacity, designed primarily for use in protecting distribution circuits in large substations in metropolitan areas. It features horizontal drawout; De-ion principle of arc interruption; ceramic arc chutes.

Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.

What is a FAIR PRICE?

*To be **FAIR**, both your customer and you must profit.*

Since 1926

NATIONAL PRICE SERVICE

suggests fair resale prices for electrical materials and tells you what they cost from day to day.

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Company _____

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City _____ Zone _____ State _____

Aluminum Louver (21)

The ½- by ½- by ½-in. "Kold-bonded" aluminum louver is now offered in a wide variety of colors. Fabricated from 0.025 aluminum, providing 45° shielding, and available in lengths up to 48 ins. and widths up to 24 ins. can be cut to varying sizes and shapes on the job. Adaptable to luminous ceilings, ceiling modules, recessed coffers, recessed troffers, and surface, pendant, and flush units.

Columbia Electric & Mfg. Co., North 2310 Fancher Way, Spokane, Wash.

Lighting Fixture (22)

A 200-watt open suburban lighting fixture for illuminating farm work areas, outbuildings, storage areas and driveways. The 4,000-lumen incandescent unit is equipped with an integral photoelectric control device that makes possible automatic dusk-to-dawn farmstead lighting. Unit has a die-cast aluminum hood with integrally-cast side mounting, and a 1¼-in. slipfitter mounting, in addition to plug-in photoelectric control. It is equipped with internal binding posts for wiring through bracket.

General Electric Co., Schenectady 5, N. Y.

Pothead (23)

A drawn steel pothead has been announced. Bell is drawn from ¼-in. copper bearing steel plate. Bell of the unit is guaranteed against breakage and porosity, as well as to meet all applicable standards of NEMA, ASA, AIEE, and the Federal Bureaus. Three standard sizes for capacity requirements to 15 kv. Mounting plates, aerial terminal lugs, and cable entrances available. Parts are interchangeable to provide for parallel or diverging insulators, outdoor or indoor installation.

Esco Mfg. Co., P. O. Box 1039, Greenville, Texas.

Digger (24)

New specially designed 2-man cab is available for the FWD Blue Ox utility digger, the new rubber-tired earth-boring and pole-setting tractor recently announced for utilities, utility contractors, and railroads. May be outfitted with canopy instead of the enclosed cab. Has rear station controls for full operation of winch and earthboring machine, in addition to standard cab controls. May be driven over paved or unpaved roads to job location.

Four Wheel Drive Auto Co., Clintonville, Wis.

Bushings (25)

A new line of insulated grounding bushings with nylon insulated throat. Temperatures to which the nylon may be subjected range from minus 25°F to 240°F for maximum protection. Bushings are of malleable iron casting with steel wedge. They are listed by UL and approved by CSA and are available for conduit ranging in diameter from ½ to 4 ins.

Thomas & Betts Co., Elizabeth, N. J.

Romex Connector (26)

New pressure Romex connector is designed for installation on non-metallic sheathed cables, portable cords, etc. Made in one piece of special heavy duty aluminum alloy. In ⅜-in trade size, connector fits standard ½ in. knockouts. To install, slide connector over cable and squeeze with channel-lock pliers or side cutters; to remove, squeeze opposite sides of connector and cable is released. More room is allowed in box for wiring. UL approved for 14/2, 14/3, 12/2, 12/3, and 10/2 non-metallic sheathed cable.

Buchanan Electrical Products Corp., Hillside, N. J.

New Concept in Construction Fastening!

REMINGTON Power-Mate* BASIC UNIT

. . . plus choice of 4 interchangeable Stud Driver Kits

K-1. CAPTIVE STUD KIT—designed to prevent free flight of studs when base material is inadequate. Used with "Power-Mate," this is safest Stud Driver ever designed.

K-2. LIGHT-DUTY KIT—produces all-purpose tool. Handles 80% of your fastening in concrete or steel. K-1 and K-2 use ¼" diameter Remington Studs and 22 caliber Power Loads.

K-3. MEDIUM-DUTY KIT permits use of ⅜" diameter Remington Studs with low-cost 22 caliber Power Loads. This assembly gives top performance . . . economically.

K-4. MEDIUM- AND HEAVY-DUTY KIT for toughest fastening jobs. Designed for use with ⅜" diameter Remington Studs and scientifically graded 22 or 32 caliber Power Loads.

Most versatile tool ever designed for fastening wood or metal to concrete or steel

Now you can have the power you want, the stud size you need with the new Remington "Power-Mate." The tool is easy to use. Just a squeeze of the trigger is all it takes to anchor wood or metal sections to concrete or steel. No pre-drilling, no outside power connections required!

The Remington "Power-Mate" is flexible, too. Permits use of ¼" or ⅜" diameter alloy steel studs and 22 or 32 caliber Remington Power Loads to furnish driving force.

Take the "Power-Mate" Basic Unit, attach the Stud Driver Kit of your choice—and the tool is ready to use! It will handle any fastening job—light, medium or heavy duty. That's why the Remington Stud Driver is the most versatile construction fastening tool ever designed!

Remington® DU PONT REG. U.S. PAT. OFF.

STUD DRIVER

*"POWER-MATE" is a trademark of Remington Arms Company, Inc.

Remington Arms Company, Inc.
Industrial Sales Division, Dept. EC-6
Bridgeport 2, Connecticut

Please send free booklet on the Remington "Power-Mate."

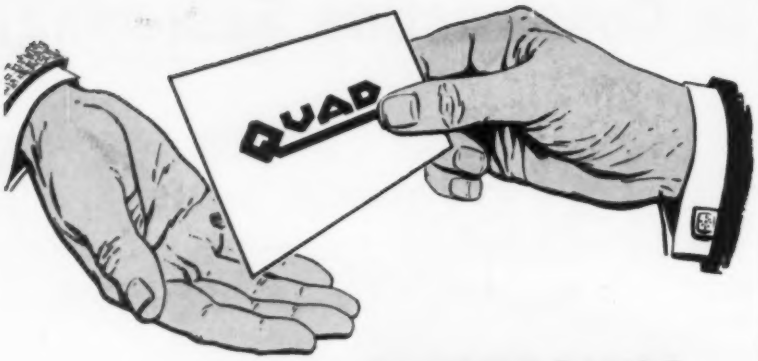
☐ I am especially interested in the Captive Stud Kit.

Name .....

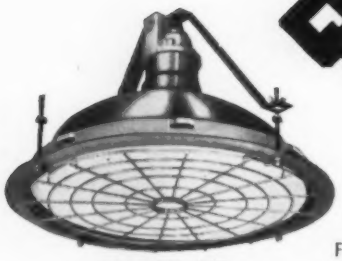
Firm .....*Title*.....

Address .....

City .....*State*.....



GYMNASIUM
LIGHTING INSTALLATIONS ARE RIGHT IN YOUR HANDS WITH
FLUSH MOUNTED
QUAD UNITS



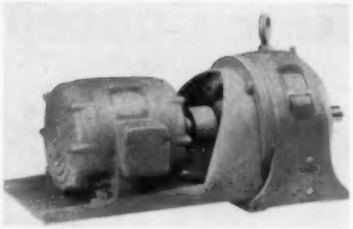
COMPLETE UNIT
Intended for Flush Mounting Only

Flush mounted, has detachable porcelain enameled reflector, cast aluminum framing ring, heavy wire guard, and a dust tight cover which is optional.

The one design that can take punishment without breakage

This unit tosses off hard knocks, such as from a basketball or indoor baseball, without damage. Its lighting efficiency remains fully effective. This QUAD unit is made to durably serve in gyms, assembly halls, rinks, armories and indoor arenas. Among its many features is the ease of servicing from either above or below a ceiling as construction conditions require. When it comes to a gymnasium lighting unit remember the name QUAD.

QUADRANGLE MFG. CO.
32 S. PEORIA ST. CHICAGO 7, ILL.



Gear Unit (27)

A motorized gear unit, called Line-A-Spede, is designed for installations where down time is critical. Line-A-Spede drives are gear reducers powered by standard NEMA frame motors mounted on a shelf attached to the reducer. Double, triple and quadruple reduction gear units, with ratios up to 1487 to 1, are available for motor ratings of 1 to 75 hp. Units are available for horizontal, vertical, flange, incline, sidewall or ceiling mounting. Bulletin No. 2350 is available.

The Louis Allis Co., 427 E. Stewart St., Milwaukee 1, Wis.

Recessed Incandescents (28)

Square recessed "Brascolites" are available with both Holophane and Corning lenses for intensive, diffusing, concave, convex, focusing, symmetrical, asymmetrical light distributions for most every type of recessed incandescent lighting application. Feature Alzak aluminum reflectors for optimum light control and permanency. Constructed of heavy-gauge steel. Die-cast frame and flange trim is finished Silvan. Plaster flange bead assures a snug fit into the ceiling and prevents light leaks. Units can be relamped from above or below. Self-aligning thumb screw and floating nut, plus sturdy hinges facilitate easy servicing.

The Edwin F. Guth Co., St. Louis 3, Mo.

Heavy-duty Connector (29)

New "KA Connector" is a two-bolt heavy-duty connector which can be worked hot. Design extends and peens one bolt (the longer bolt) to make a one-piece assembly. The shorter bolt is equipped with a rubber grommet so it can be threaded out from the upper casting and held by the lower casting; lower casting and spacer can then be pivoted 180°. The connector can be installed with hot line sticks.

Anderson Electric Corp., P. O. Box 2151, Birmingham 1, Ala.

Vise Stand (30)

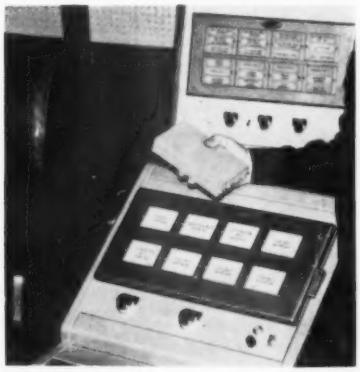
New modified vise stand, the "8A", has mounting holes for most of the popular-make vises, and elastic stop nuts for all fastened elements. Rubber foot pads prevent scratching and marring of floors. Other features include: steel tray, three integral pipe benders, tool slots, pipe rest, and an adjustable bracket for use with ceiling brace.

Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo 4, Ohio.

Tape (31)

New tape, designated Permacel 422, is recommended for use where Class H insulation is required; where high insulation and abrasion resistance is required, for electrical uses such as slot liners in motors, generators, coil wrapping, coil separators within slots and as conductor insulation for armature and field coils. The tape has excellent weather resistance, low temperature flexibility and high temperature operating capacity, making it well suited to outdoor insulation for large power installations. Is constructed from a 2 mil Teflon film sintered backing and a thermosetting silicone adhesive.

Permacel-LePage's Inc., New Brunswick, N. J.

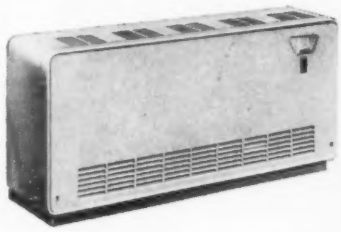


Annunciator (32)

A new type of annunciator for monitoring complex automatic systems has been developed. It uses static-magnetic controls. It reports "off-normal" occurrences on an instrument type panel by both visual and audible means. Plug-in design makes it possible to change sequences without rewiring, or to expand the annunciator system as required.

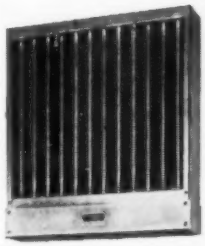
Panellit, Inc., 7401 North Hamlin, Skokie, Ill.

Chromalox Electric Heat... your hottest market



Chromalox
Electric Unit Ventilator

Chromalox
Automatic Wall-Insert Heater



Chromalox In-Duct Heater

Chromalox Floor Drop-in Heater

Cash in with CHROMALOX— the complete quality line

Wherever heat is needed for comfort, electric heat is finding new uses. In homes, churches, factory offices, schools, motels.

And not just new structures, but existing structures are finding electric heat the modern method of heating. Electric utilities are promoting this new, big market. Are you tying in? With the conversion market, as well as the new institutional construction, there's a double-barrelled market waiting.

Although the Chromalox line is renowned for quality everywhere, it isn't more expensive. The built-in quality Chromalox offers assures you of customer satisfaction, without callback for complaints. Attractive appearance, long life, and fast installation are all in your favor.

Why not learn the electric heating story now? Write for full details. You'll find nation-wide distribution and local Chromalox engineering assistance to back your efforts.

Write now . . . so that you can *heat better — electrically.*

3664

Chromalox Electric Heat

Edwin L. Wiegand Company
7637 Thomas Boulevard
Pittsburgh 8, Pennsylvania
CHurchill 2-6400
See our complete line in Sweet's Catalog

START-STOP STATION with pilot. For surface mounting.
SELECTOR SWITCH with pilot. Brass plate for flush mounting.
SIZE 1 MAGNETIC STARTER with selector switch in cover.
SIZE 0 COMBINATION STARTER with fusible disconnect and local control.
MANUAL STARTER with pilot. For surface mounting.
MANUAL STARTER and selector switch. For surface mounting.

ARROW AH HART

You'll build bigger HEATING & VENTILATING PROFITS with these controls because . . .

. . . **THEY'RE EASIER TO INSTALL AND MAINTAIN,** helping to make your work more profitable. And their added performance and dependability help build your business by insuring more satisfied customers.

. . . **THIS IS THE ONLY *COMPLETE* LINE** of motor controls and pilot devices for *all* heating and ventilating applications including: fans, blowers, unit heaters and ventilators, compressors and pumps.

. . . **ONLY ARROW-HART** offers you a line that includes far smaller, lighter Type "RA" Magnetic Controls that save valuable space and help you reduce installation time and costs.

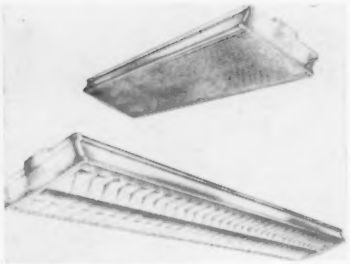
Act *now* to make your next job more profitable. Send today for your free 16-page booklet completely describing how to wire Arrow-Hart Motor Controls.

Write to The Arrow-Hart & Hegeman Electric Company, Dept. ECM, 103 Hawthorn Street, Hartford 6, Connecticut.

ARROW AH HART

Quality since 1890

MOTOR CONTROLS · ENCLOSED SWITCHES
APPLIANCE SWITCHES · WIRING DEVICES



Surface Fluorescent (33)

The new "Guthlite Jr." fluorescent luminaires provide lighting for general area illumination, complimented by soft-glo, all metal, light spill sides. Features new Prismoid Gratelite bottoms. Breathing-action assures lamp and ballast ventilation. Also available with white metal cross baffles, or Gratelite louver diffuser bottoms in 4-in. and 8-in. lengths, 2- and 4-light widths. Constructed of heavy-gauge, zinc-coated and phosphatized steel, finished in white Permalux. Fixtures are used for 40% up and 60% downlighting, but with top plates can be adapted for 100% downlighting; for either close-ceiling or pendant installations, in continuous rows or individual mountings. UL listed.

Edwin F. Guth Co., 2615 Washington Blvd., St. Louis 3, Mo.

Contactors (34)

New line of 30-amp starters and contactors specifically designed and engineered for controlling commercial air conditioning and refrigeration compressor motors. Other controls include the 50-amp starters and contactors. 30-amp starters and contactors are supplied in 2-, 3-, and 4-pole models. Extra poles may be used for fan and damper motors. Coil wattage values for all models are 29 watts inrush and 2 watts sealed, in all standard voltages. Supplied as open units or with NEMA type I enclosures with slotted mounting holes.

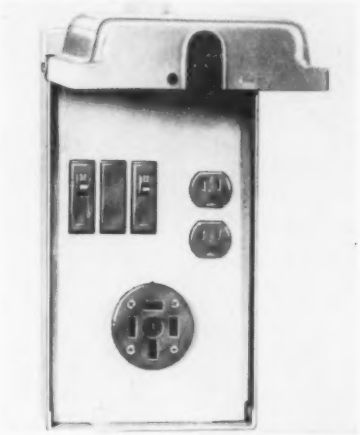
The Arrow-Hart & Hegeman Electric Co., 103 Hawthorn St., Hartford 6, Conn.

Long Scale Meters (35)

A new series of large rectangular panel instruments are offered. Models 1371 and 1375 in this series utilize CORMAG mechanisms and can be mounted on magnetic or non-magnetic panels. All plastic transparent cover with clear top and sides insures illumination of the long scale. Models 1373 and

1377 are available with outside magnetic construction; other features same as 1371 and 1375 series. All models measure approx. 7¾ by 6¼ ins. and are 1.01 ins. thick.

Weston Instruments, Div. of Daystrom, Inc., Newark 12, *N. J.*



Power Outlet **(36)**

A new weatherproof, all-purpose, 4-wire power outlet designed for use especially by mobile home parks, outdoor construction, farms and ranches. Model P-55-C has a 50-amp, 250-volt, 4-wire power receptacle and is protected with a 2-pole, 50-amp circuit breaker. It also has a grounded-type duplex receptacle protected with a 1-pole, 20-amp circuit breaker. Top hub and bottom knockouts facilitate overhead or underground connections.

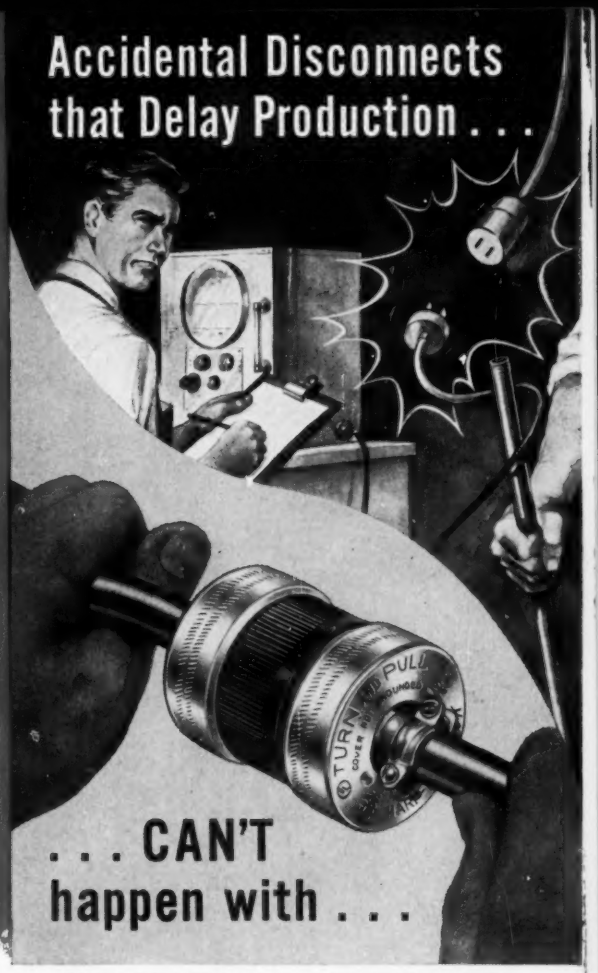
Midwest Electric Products, Inc., Mankato, Minn.

Secondary Arresters **(37)**

Line of Pyrex-housed valve-type arresters includes a new secondary arrester, type S3, designed to provide lightning protection for low-voltage equipment, secondary distribution circuits, control circuits, and signal circuits in the range of 0 to 650 volts, ac. Spark gap consists of a multiple-point electrode spaced by high-dielectric ceramic. Arrester valve elements are Granulon which freely conducts surge current but offers high resistance to follow current. S3 arresters meet NEMA LA-5-1952 and ASA C62.1-1957 standards. New T hangers are available for either SP or DP mounting.

Line Material Industries, McGraw-Edison Co., Milwaukee 1, *Wis.*

ARROW HART



LISTED AS STANDARD BY UNDERWRITERS' LABORATORIES

ARROW-HART
HART-LOCK
Interlocking Wiring Devices

DEPENDABLE . . .
Hart-Lock *cannot* be disconnected accidentally by tripping or vibration! Prevents production delays and unexpected operating costs caused by power interruptions.

TOUGH . . .
Like *all* Arrow-Hart Wiring Devices, they stand up to *rough* treatment. Available in grounded types for safety.

For free Hart-Lock booklet write: The Arrow-Hart & Hegeman Electric Co., Dept. ECM, 103 Hawthorn St., Hartford 6, Conn. Offices and sales engineers in principal cities.

ARROW AH HART
Quality since 1890

MOTOR CONTROLS • ENCLOSED SWITCHES
APPLIANCE SWITCHES • WIRING DEVICES

Compression Connectors (38)

New single and double tap "Shure Splicing" connectors can be used as dead ends and stirrups. Designed for use on all aluminum and aluminum-to-copper connections. Line also includes right angle tap connectors and pin terminals for connecting aluminum and ACSR to copper equipment terminals. All connectors have king-size contact length. Paltap connector is for single taps and dead ending. Twintap connector is designed to accept two tap conductors; tap portion has a solid barrier between conductor bores to provide a positive cable stop and assure even application of compound.

The Thomas & Betts Co., Elizabeth, N. J.

Outdoor Lights (39)

New series of outdoor packaged lighting offers a wide selection of luminaires and bracketing equipment. No. 600 and No. 100D series consists of spun-on Alzak reflector sealed over the glass. Cast aluminum hood portion of luminaire includes photoelectric cell and mercury vapor ballast integrally mounted for 100- or 175-watt mercury vapor lamps. When 400-watt mv lamp is used, a 400-watt ballast is provided for remote mounting. Available for incandescent lamps up to 500 watts. No. W52A hinged aluminum wall bracket folds to wall for servicing.

Nepo Mfg. Co., 4230 N. Sayre Ave., Chicago, Ill.

Voltage Regulator (40)

New line of 3-phase feeder voltage regulators has been announced. Rated 500 and 750 kva, 8660 volts and 500, 750, and 1000 kva, 13,200 volts. Regulators offer reduced weight, less installation space, and lower cost for 3-phase regulation.

Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.

Suspension Insulator (41)

New No. 961 "Fogbowl" suspension insulator has reduced exposed insulator area and reduced contamination on the surface by means of a "trapped air space" within the insulator bowl. Shell is a ceramically welded one piece unit. Striking and leakage distances are scientifically balanced. Supplied with malleable iron or forged steel caps and forged steel ball bolts. Recommended for use in vertical construction under fog and smog conditions, in salt spray areas, industrial locations and sandy areas.

Victor Insulators Div., I-T-E Circuit Breaker Co., Inc., Victor, N. Y.

Limit Switch (42)

A new air-gap limit switch designed for mill duty. Switch operates on the principle of a resonant circuit. Switch consists of three parts: a magnetic vane which is attached to the moving part of the machine, a reactor unit mounted on the stationary part of the machine, and a standard ac relay which opens or closes the circuit. High sensitivity permits the switch to function when the vane is within ¼ in. of reactor. Bulletin 9007-RZ available.

Electric Controller & Mfg. Co., Div. of Square D, 4500 Lee Rd., Cleveland 28, Ohio.

Radiant Heater (43)

New wall-type radiant heater, designed for bathroom or small room. Solid aluminum reflector is designed to spread warm rays in all directions. It is flush type and made in both automatic and manual models. It has adjustable mounting bars, which serve to position heater for different wall construction, either plaster or dry wall. There are mounting holes in the flange and sides of wall box for existing construction. Literature is available.

Electromode Division of Commercial Controls Corp., Rochester 3, N. Y.

Foot Switch (44)

A new type of electrical foot switch, called "Neptune", has been designed especially for use in control and low power circuits. Switch electrodes are embedded in a flexible vinyl plastic which is resistant to water, oils, greases, and most other common chemicals. Available in brown, blue, green and gray; are ½ in. thick, 6 ins. wide, and 8 ins. long. Especially designed to actuate food processing equipment where waterproof construction makes possible the necessary sanitary maintenance.

The Recora Co., Inc., 6100 S. Archer Rd., Summit, Ill.

Sylvania COP* starters

Robot COP* Automatic Reset. Built-in, thermal-operated device cuts flashing or non-operating lamp out of circuit. When defective lamp is replaced, starter automatically resets to operate new lamp. Designed for hard-to-start conditions —such as high humidity, ungrounded fixtures, low line voltage. Features ceramic condenser!

COP* Manual Reset. Circuit-breaker element cuts flashing or non-operating lamp out of circuit until new lamp is installed. Push button at top of starter permits manual resetting of circuit-breaker for proper lamp operation when relamping. Features ceramic condenser!

cut maintenance costs... protect against expensive ballast burnouts!

Sylvania COP(*Cut-Out Premium)starters offer money-saving advantages. The circuit-breaker device AUTOMATICALLY cuts out failing lamps—starter life is not "used-up" trying to start defective lamps.

This automatic starter service saves time and work . . . eliminates annoyance of flashing lamps, postpones the need for lamp replacement, thus permitting group lamp replacement at less cost.

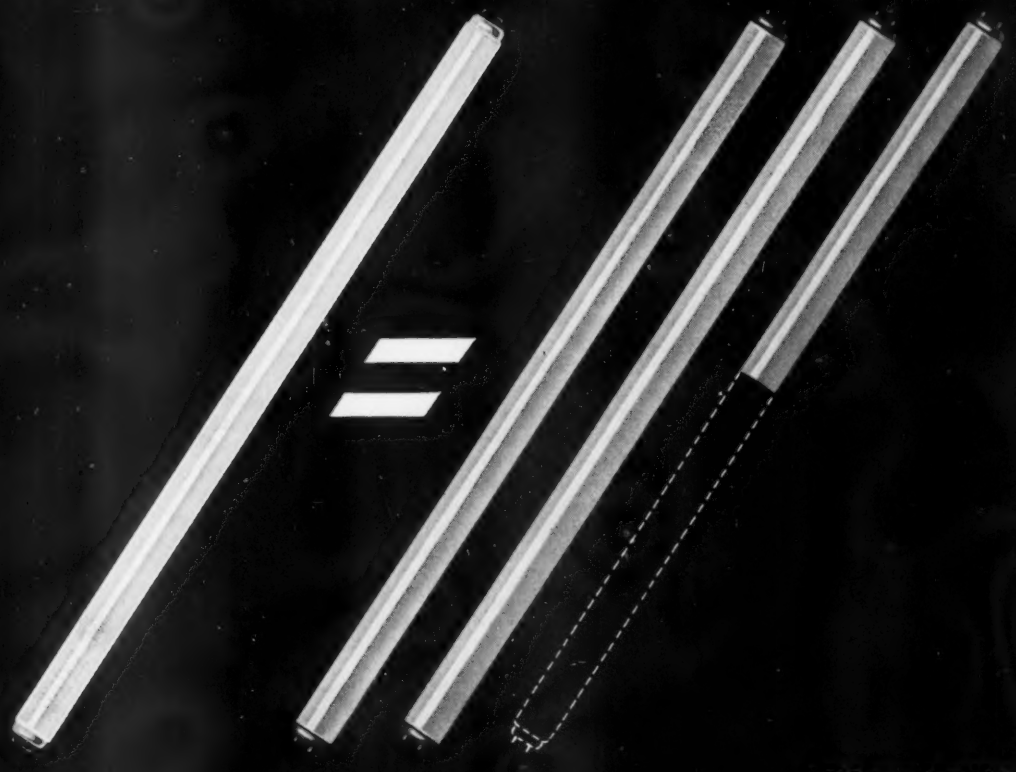
Sylvania COP starters protect equipment against ballast burnout from excessive heat produced by flashing lamps.

You get longer service with COP starters because, like all Sylvania starters, they have ceramic condensers. Condensers don't break down due to temperature or moisture—the cause of failure in starters with paper condensers. Order a stock today from your Sylvania Supplier.

SYLVANIA ELECTRIC PRODUCTS INC.
Lighting Division, Dept. 8L-8306
60 Boston Street, Salem, Mass.
In Canada: Sylvania Electric (Canada) Ltd. Shell Tower Building, Montreal

SYLVANIA
...fastest growing name in sight!
Lighting • Television • Radio • Electronics
Photography • Atomic Energy • Chemistry-Metallurgy

With no change in tube shape or size, new Sylvania **VHO** delivers as much light as 2½ standard fluorescent tubes



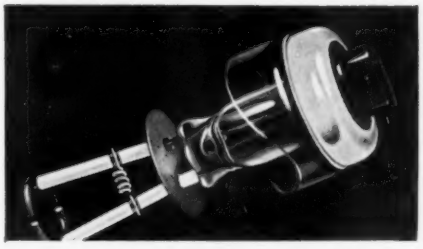
VHO means Very High Output

Another reason why

Sylvania Fluorescents give more light at lower cost than all other brands

No other very high intensity fluorescents cost so little to buy and use – or maintain greater brightness throughout lamp life. The new VHO fluorescent lamp looks like any standard lamp—yet it delivers more than 2½ times as much light as lamps of identical size and shape. The initial cost of Sylvania VHO is appreciably lower than any other high intensity fluorescent lamps, and at no sacrifice in service or performance. VHO lamps keep operating costs to a minimum by giving more effective, useful light than other high intensity fluorescent lamps.

SYLVANIA LIGHTING PRODUCTS
Division of Sylvania Electric Products Inc.
60 Boston Street, Salem, Massachusetts



The secret of the VHO is the unique "Pressure Control Center" inside the tube. This exclusive development creates a cooler lamp interior that has enabled Sylvania to pack more than 2½ times as much light into a standard size tube.

SYLVANIA Lighting Products

make light a better tool for profits

LIGHTING • TELEVISION • RADIO • ELECTRONICS • PHOTOGRAPHY • ATOMIC ENERGY • CHEMISTRY-METALLURGY

Latrobe *Electrical* Products

For long, smooth service "Latrobe" Floor Boxes and wiring specialties are tops. Years of performance have proved that. And, "Latrobe" Boxes are designed in a way that permits fast, easy installation—cutting labor costs to the bone.

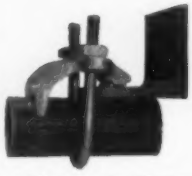
Non-Adjustable Watertight Floor Box

Unique, practical design cuts installation time; makes safer job and leaves more wire space inside box. Cover plate is 3½" diameter.

Adjustable Floor Box

Designed for telephone outlet or where permanent connections are made, or as a junction box. All adjustable boxes are fire proof.

"Latrobe" Pipe or Conduit Clamp



This clamp is made with a double safety bite of case hardened tool steel. Two models — Right Angle and the Parallel support. Each model comes in 10 sizes to handle pipe or conduit ½" thru 4".

Insulator Supports

Fasten porcelain or glass insulators to steel framework without punching holes. 4 sizes—1", 1½", 2" and 2½".

Latrobe Products

Non-Adjustable Floor Boxes
Adjustable Floor Boxes
Gang Boxes . . . Cover Plates
Junction Boxes . . . Nozzles
Pipe or Conduit Hangers
Insulator Supports
Cable Supports . . . Fish Wire
Staple and Cable Clips

Write for new catalog

Sales Representatives in all principal cities.

Fullman Manufacturing Co.
1209-1215 JEFFERSON STREET
LATROBE, PA.

Load Center (45)

New line of raintight, NEMA type 3R circuit breaker load centers with "Twin" residential breaker in 12, 16 and 20-circuit split bus devices has been introduced. For outdoor applications up to 100 amps, where breakers must be protected from rain, sleet, and snow. Features interchangeable raintight conduit hubs up to 2½ ins., type TR "Twin" breakers, type R single-pole and type TQL 2-pole common-trip breakers, and provision for bringing conduit into the box through an interchangeable hub in the top or through knockouts in the bottom and back. UL listed. Bulletin GE-6661A available.

General Electric Co., Plainville, Conn.

Capacitors (46)

Individual capacitor units, rated to deliver 100 kvar, will be available in standard voltage ratings of 4800, 6640, 7200, 7620, and 7960 volts. Each unit full-voltage energization tested. Capacitors will permit lower installation costs per kvar, savings in space required for substation racks, and more compact pole mounted banks. Both single bushing and two bushing styles will be produced to allow the greatest possible flexibility of application.

Cornell-Dubilier Electric Corp., South Plainfield, N. J.

Fluorescent Lights (47)

Three new series of shallow fluorescent "PlastoLiers" incorporating a one-piece metal housing and one-piece snap-in plastic shielding, are designed to provide low brightness illumination with even distribution when surface or pendant mounted, individually or in continuous runs. A plastic pan series using a formed acrylic diffuser is available with two to eight lamps in sizes from 1 by 4 ft to 4 by 4 ft. Single lamps, 6 ins. wide, are available in 2-, 4 and 8-ft lengths for corridors and passageways. Wrap-around provides direct or semi-direct lighting through an extruded polystyrene diffuser which wraps around the bottom, sides and top of the one-piece metal housing. These units are 3½ ins. deep overall including diffuser, are available in two and four lamp in 4-ft lengths.

Metalcraft Products Company, Inc., Philadelphia, Pa.

Wire Joint (48)

A new Sta-Kon wire joint designed for a maximum of four No. 10 wires, and an enlarged joint for four No. 12 wires. Larger wire joint, Cat. No. PT-80, will join combinations of Nos. 10, 12, 14 and 16 AWG solid or stranded wires, with four No. 10 wires as maximum combination. It features a flared entrance opening and an open end. It has UL approval for general service use, as well as for fixture wiring.

Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.

Fuse Cartridge (49)

New high interrupting capacity fuse carriage for use with main or remotely located circuit breakers. Mounted on "positive lock" draw-out mechanism, the fuses are available in continuous load ratings from 400 amps to 6000 amps. Some of the features are: operating mechanical and electrical interlocks; removable front; design incorporates a striker pin device which prevents single phasing and reclosing on a fault. Bulletin 1020 is available.

Penn Electrical Company, Irwin, Pa.

Program Time Switch (50)

A program time switch with 96 tabs fixed to its 24-hour dial to permit 15-minute switching changes. Called Model-"8001", it serves wherever intermittent daily operation is required, and provides from 1 to 48 ON-OFF operations per day. For setting, tabs are manually tilted in or out. Skip-A-Day feature is available as optional equipment. The heavy duty timing motor, rated 10 amps ½ hp, operates in temperatures from minus 60° to plus 160°F. Switches are also available in 208-240 volts 60 cycle models, and in raintight and all-weather dust tight cases.

Tork Time Controls, Inc., Mount Vernon, N. Y.

Duplex Receptacle (51)

A new 2-circuit duplex ground receptacle, No. 394, contains two units: 15-amp, 250 volts, tandem or parallel blade face, with "U" grounding and 3-wire, 20-amp, 250 volts, crow-foot style. Ground terminals are connected to the corrosion resistant strap. Design permits back- or side-wiring of screw terminals.

Slater Electric and Manufacturing Co., Glen Cove, L. I., N. Y.

Industrial Lighting Unit (52)

A complete new line of Brascolite industrial incandescent units available for low-bay, high bay and special industrial applications using both incandescent and mercury vapor lamps. Units are formed of aluminum and processed Alzak. Ventilated, black-top socket covers are furnished on all 100% downlight reflector units. Luminaires are also available with 15% uplight. Porcelain lampholders and die-cast fittings are listed by UL.

Edwin F. Guth Company, 2615 Washington Blvd., St. Louis 3, Mo.

Circuit Breaker (53)

Type QO plug-in circuit breaker now gives protection against "flash" shorts. The time-delay characteristic prevents nuisance tripping on momentary, overloads and motor starting. Available in single and 3-pole forms in ratings from 15 to 50 amps, and in 2-pole forms to 70 amps. Each pole is in its own case, and all cases are the same size. Breakers are suitable for both load centers and panelboards, 2 through 42 circuits. Bulletin is available.

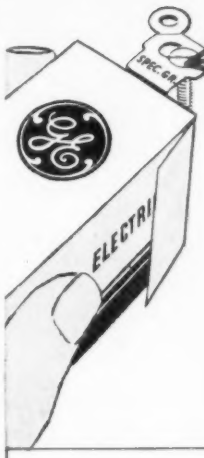
Square D Company, 6060 Rivard St., Detroit 11, Mich.

Service Equipment (54)

Service equipment designed for use for temporary service during building construction. It is a self-contained, raintight unit. Grounded receptacles for 110-volt, 3-wire, and 220-volt, 4-wire tools. Each receptacle is separately protected by breaker for overload. 100-amp meter socket and raintight hub are provided. Dimensions are 18 ins. high, 8 ins. wide and 4½ ins. deep. It is UL approved.

Blakeman Bros. Electric Mfg. Co., Inc., 5859 Compton Ave., Los Angeles 1, Calif.

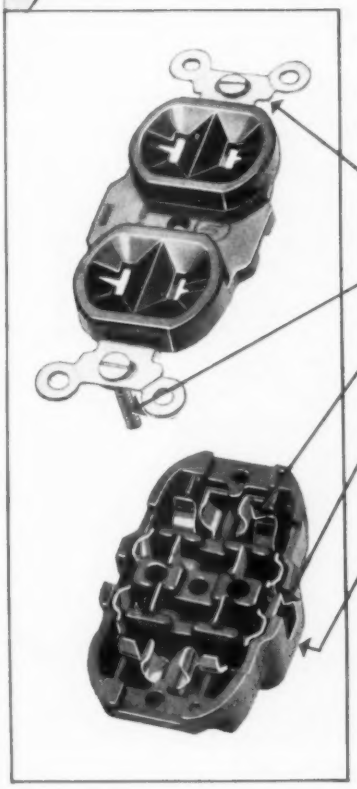
SPEC. GR.



This symbol on

Specification Grade G-E Wiring Devices

assures you of extra features for handy installation and long, satisfactory service



The GE4029 de luxe grade outlet with pressure-lock terminals is typical of the extra-high quality you get in *all* G-E Specification Grade Wiring Devices

- Plated mounting strap passing *through* device is clamped firmly between face and base. Won't bend out of position during wiring.
- Plaster-cleaning screws are held in strap by fiber washers . . . all ready for mounting.
- T-slots, with double-wipe contacts, in rugged, two-piece molded plastic housing . . . assure dependable service.
- Break-off links between terminals can be easily removed with screwdriver, making outlet convertible to separate feed or separate ground if desired.
- Pressure-lock terminals lock stripped portion of each wire *inside* device, for positive, neat, totally-enclosed connection. Each terminal accepts one No. 10 Awg or two Nos. 14 or 12 Awg wires. Three outgoing feeders can be inserted for extension to other outlets, lampholders, etc.
- 15A, 125V rating. Available in brown, ivory. Listed by U.L., meets Federal and REA specifications.

Choose from the line of General Electric Specification Grade Wiring Devices for easier, more profitable, more dependable wiring installations. These high-quality devices contribute to the best reputations of the men who recommend or use them. General Electric Company, Wiring Device Department, Providence 7, Rhode Island.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Match the conditions on your jobs

TYPE AND VOLTAGE RATING	CHARACTERISTICS	GENERAL APPLICATIONS	INSTALLATION METHODS
RUBBER—Insulated Control Cables			
Rubber-Insulated 600-Volts	The standard Anaconda rubber control cable—with excellent moisture resistance, heat stability and long-aging characteristics.	General-purpose and station control requirements of utilities and industrials.	Can be installed aerially, in conduit, underground in ducts – or buried directly in the earth.
Ozone-Resistant Rubber-Insulated 600-Volts	An ozone-resistant control cable also possessing proved moisture resistance, heat stability and long-aging characteristics.		
THERMOPLASTIC—Insulated Control Cables			
Polyethylene-Insulated 600-Volts	A standard Anaconda thermoplastic control cable with excellent moisture and chemical resistance. Highly resistant to electro-endosmosis. A long-lived cable.	General-purpose control requirements of utilities and industrials.	Can be installed aerially, in conduits, underground in ducts—or buried directly in the earth.
DENSHEATH® Insulated 600-Volts	A standard Anaconda thermoplastic control cable with excellent moisture and chemical resistance. Long-aging performance.		
Anaconda Type PND* Polyethylene-Insulated – Nylon Conductor Cover 600-Volts**	An approved control cable with dependable chemical and abrasion resistance. Features small diameter. Long-aging properties.	General-purpose control requirements of utilities and industrials where space is a limiting factor.	Can be installed aerially, in conduit or underground in ducts.
Polyethylene-Insulated 1000-Volts	A thermoplastic control cable excelling in moisture and chemical resistance. Features heavy insulation thickness. Long-aging characteristics.	Station control requirements of utilities and industrials.	Can be installed aerially, in conduit, underground in ducts – or buried directly in the earth.

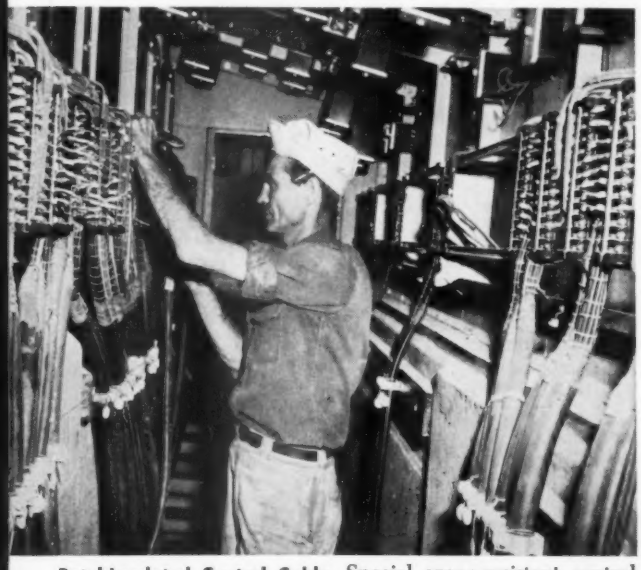
**IPCEA voltage rating is 300 volts.
*Trademark

Lead sheaths are furnished on rubber-insulated control cables if requested.
Interlocked armor is available for all types of control cable.

with these Anaconda Control Cables

Anaconda's Type ANW-Rubber-Insulated Control Cable. High-quality product offering peak reliability, outstanding heat resistance. Cable is also highly resistant to moisture, acids, alkalies, other chemicals. Unusual overload capacity and long-aging characteristics. Individual conductor covering and over-all jacket of neoprene.

Anaconda Thermoplastic Control Cable Multiple-use. Can be installed aerially, in conduit, underground in ducts, or buried directly in earth. Available with polyethylene (600 or 1000 volts) or Densheath* vinyl resin (600 volts) insulation and Densheath over-all jacket. Densheath jackets over polyethylene-insulated conductors on request.



Butyl-Insulated Control Cable. Special ozone-resistant control cable. Individual conductor covering and over-all jacket of neoprene provide maximum insurance against moisture and mechanical injury.

Anaconda Type PND Control Cable. For general-purpose uses where space is a limiting factor. Allows installation of a 12-conductor cable in conduit carrying a 6 or 7. Individual conductor covering of abrasion-, oil- and gasoline-resistant nylon.

Permanent Full-Color Coding on rubber cables, by means of Anaconda's rubber-base coating, assures quick and positive circuit identification. Coding by surface printing, which conforms to IPCEA standards, also available. On thermoplastic cables, full-color coding with pigmented insulation and surface printed coding are likewise offered.

For full information on any of Anaconda's complete line of control cables – including cables engineered for more specialized control requirements – see your Anaconda distributor or the Man from Anaconda. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

*Reg. U.S. Pat. Off. 5830C

LIVE BETTER ELECTRICALLY

SEE THE MAN FROM **ANACONDA®**
FOR **CONTROL CABLE**

lighting
design
by
mc Philben

45W wall mounted edge-lit

45R recessed
ceiling mounted edge-lit

cast aluminum
quality

mc Philben's 45 line edge-lit directionals are designed to blend with the finest contemporary decor in hotel lobbies, auditoriums, office buildings, schools and other public locations.

Gleaming satin finish . . . solid cast aluminum construction . . . wall, ceiling or surface mountings . . . incandescent and fluorescent models . . . invisibly hinged access doors . . . flush fasteners . . . acrylic Plexiglass inscription panels illuminating full length of letter . . . these are some of the features making mc Philben's 45 line edge-lit directionals the architect's first choice for use in the nation's finest buildings.

The 45 line series is available with either "exit" or special wording inscriptions. 4½", 6" or 8" lettering with red, green and white color combinations conform with all local regulations.

Contact your mc Philben representative today for full details. See our insert in Sweet's file or write for data sheet E/1.

mc Philben
LIGHTING COMPANY
1329 Willoughby Avenue
Brooklyn 37, New York

Insulated Motor (55)

A line of "Super-Seal" motors with silicone-rubber "Silco-Flex" insulation rated for Class B temperature rise. Open type "Super-Seal" motors rely on protective qualities inherent in the Silco-Flex system to withstand atmospheric contaminants. A 500-hp motor stator, fully wound with Silco-Flex insulation for 4000 volts, was immersed completely in water with 18,000 volts applied without breakdown. Resistant to oils and chemicals, found in many industrial applications, motors need no extra protection against corrosives or oils.

Allis-Chalmers Manufacturing Co., Milwaukee 1, *Wis.*

Telephone Cabinets (56)

A new line of standard telephone cabinets, matching lighting and power panelboards in appearance and construction, has been announced. Designed for easy wiring, with many conveniently placed knockouts, the telephone cabinets consist of separate box, trim, and optional wood backing. Boxes are fabricated from galvanized steel. The cabinet locks match the panelboard locks and can be operated by the same key.

Square D Co., 6060 *Rivard St., Detroit* 11, *Mich.*

Motors (57)

New line of ac motors built to NEMA rerate specifications. Takes advantage of technical improvements and high temperature resisting insulations. Motor is lighter in weight and smaller. Temperature rise remains 40° C. Bulletin 860 available.

Brook Motor Corp., 3553 *West Peterson Ave., Chicago* 45, *Ill.*

Powder Actuated Tool (58)

New model GH-1 "Green Hornet" for driving headed or threaded studs into concrete or steel with energy created by a discharge from a blank cartridge. Trigger activation, push-type replacement of barrel units, and a shape better fitted to hand contour for easier, faster handling are among the design improvements. Easily inserted interchangeable ¼- and ⅜-in. barrels give the tool a dual versatility.

Velocity Power Tool Co., 201 *N. Braddock Ave., Pittsburgh* 8, *Pa.*

Lighting Fixtures (59)

Three new styles of lighting fixtures, "Aerolyte", "Intermezzo" and "Aurora", have been announced. Designs blend with contemporary and traditional decors. Available in 5- and 3-light chandeliers, 1- and 2-light wall sconces, and single suspended spheres. Curving brass arms stem from glass chimneys and globes feature textured white-on-white. Others, with white plastic cords, adjustable in length.

Lightolier, Inc., Jersey City, N. J.

Lifting Device (60)

A new device for lifting low voltage power circuit breakers into, and out of, low voltage switchgear cubicles where ceiling mounted hoists are not applicable. Capable of handling 500 lbs, the hoist is positioned on a dual channel track bolted to top of switchgear lineup. It can be conveniently positioned along the track to handle any breaker unit in the lineup. Hoist projects over drawout aisleway and is held in position by weight of breaker and a rear restraining channel with the front track angle acting as the fulcrum.

Allis-Chalmers Mfg. Co., Milwaukee 1, *Wis.*

Mercury Floodlights (61)

Full line of open, general purpose enclosed, and heavy-duty enclosed floodlights is now available for use with mercury lamps. Will accommodate 100- to 1,000-watt mercury lamps. Ballasts are available in popular voltage ratings. The large L-100 open and enclosed units, the L-55 porcelain-enameled open units, and the L-80 medium-sized enclosed floodlights are equipped with a threaded stud which fits any 1½-in. pipe fitting. Positioning is assured by meshing teeth on the support arm stud housing. Internal or exposed cable wiring may be used with the floodlights. Flat mounting bases are available. Cross-arm mounting brackets are employed for mounting the deluxe L-69A general purpose units and are optional on all other units. Easy-to-read degree scales are included on all units to facilitate aiming. Threaded stud and flat mounting bases also available for types L-82A, L-83A, L-84A, and L85A.

General Electric Co., Schenectady 5, *N. Y.*

Catalogs & Bulletins

(62) ROOF VENTILATORS with backward curved Airfoil design which permits moving more air with less noise in exhaust and supply applications are described in new 8-page bulletin. ILG Electric Ventilating Co.

(63) LIGHTWEIGHT BATTERY for switchgear, alarm systems, telephone control, signalling, emergency lighting and other services rated from 50 to 1140 ampere-hours is detailed in new 12-page catalog GB-1833. Gould-National Batteries, Inc.

(64) SUSPENSION INSULATORS and hardware and conductor clamp selection tables for selecting suspension and strain clamps for various conductors are presented in two new catalogs. Delta-Star Electric Div., H. K. Porter Co., Inc.

(65) POLE-TYPE TRANSFORMERS for distribution. Bulletin 135-A, 8 pages, gives characteristics, tap ratings, bushing terminal sizes and other factors. R. E. Uptegraff Mfg. Co.

(66) SOLDERING TIPS. Plug and screw-type tips for soldering irons, multicoated for extra long wear, are listed together with data on the diameter, style of tip point, dimensions of point and length are given in new catalog 600. Hexacon Electric Co.

(67) LATCH-TYPE RELAYS. Bulletin 7305-PML describes new line of mechanically held latched-in relays which have the same vertical height as standard relays. Clark Controller Co.

(68) CIRCUIT BREAKERS for protection of motor circuits. 8-page bulletin 5040-A reviews features and applications of type ETI molded-case breakers recommended for use in series with, and directly ahead of, motor-running overcurrent device. I-T-E Circuit Breaker Co.

(69) ELECTRIC HEAT CONTROL. Data Sheet F 8705 describes positive-acting packaged step control which eliminates the necessity of expensive variable voltage regulators and magnetic contactors in the control of the electrical input to classroom-type electric heat unit ventilator. Barber-Colman Co.

with self-feeding chatterproof

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2-S Spiral

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(76) LUMINOUS TUBE TRANSFORMERS. Bulletin GEA-5859, 6 pages, gives data on complete line available in five basic case sizes in ratings from 5000/30 to 15000/120 ma. General Electric Co.

(77) SECONDARY UNIT SUBSTATIONS from simple radial systems to secondary selective systems are completely described in new bulletin 18B6285C. Allis-Chalmers Mfg. Co.

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(79) PLUG-IN BUSWAY, Type DE. New 225-1000 amp. plug-in Flex-A-Power busway with aluminum conductors, designed for indoor use in industrial plants and commercial buildings and having a 50,000-amp rms asymmetrical short-circuit bracing is covered in new catalog GEA-6173, 24 pages. General Electric Co.

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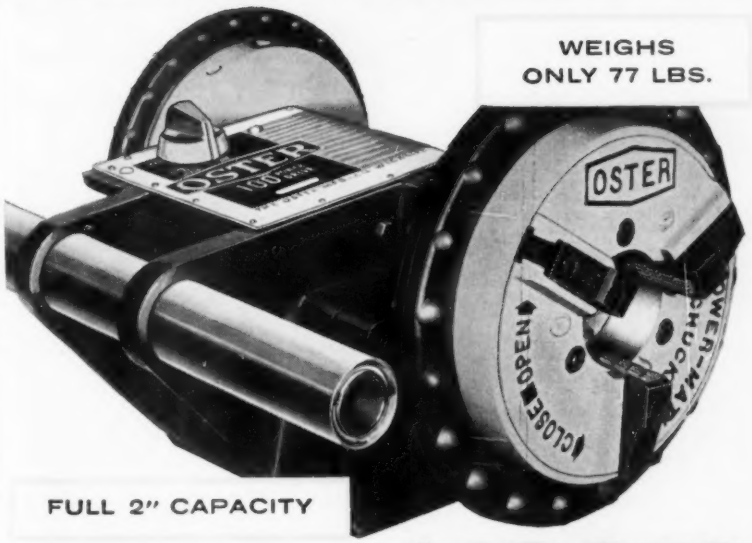

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(92) OUTDOOR OIL CIRCUIT BREAKERS, rated from 69 through 345 kv, 1500 through 25,000 mva. 8 pages, 71B6022D. Allis-Chalmers Mfg. Co.

(93) CHEMICAL BRUSH CONTROL. Bulletin discusses use of chemicals to control vegetation along wireline right of ways and substations. Dow Chemical Co.

(94) FLUORESCENT FIXTURES. Troffers of all types plus full line of louvered, reflector and bare lamp channels are described and illustrated in 75-page catalog C-557. Keystone Mfg. Co.

(95) MOTOR APPLICATION GUIDE, 12 pages, matches motor characteristics and load requirements to make motor selection easier. Century Electric Co.

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(109) TRANSFORMERS. 12-page catalog contains close-up and cutaway photos and drawings of new self-protected transformers. Delta-Star Electric Div., H. K. Porter Co., Inc.

(110) MERCURY VAPOR LIGHTING for hazardous locations. Bulletin 2705 describes fixtures with five styles of reflectors, plus two styles of dust-ignition-proof fixtures. Crouse-Hinds Co.

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KVAR and Transformer Loading

QUESTION Z33—Our paper mill is located at the end of a long transmission line. On holidays our plant is shut down except for lighting and emergency pumps. When the plant is down, the voltage on our transformer rises 25%. We have a reactive volt-ampere meter on the primary side of our main transformer bank. What should the kvar of an idle transformer bank be at 75%, 100%, 125% voltage? The transformer bank has a 1000-kva setting, 2400 volts to 440 volts, 3-phase.—M.D.

ANSWER TO Z33—The kvar requirements of power transformers at higher-than-normal voltage have a very wide range. At the elevated voltages the core steel becomes saturated (at least to some degree) and the transformer will draw higher-than-normal exciting current. For a 1000 kva, 3-phase, 2400-volt to 480-volt modern transformer, a typical range of exciting current at 125% voltage is 15% to 30% rated current resulting in approximately the same kvar requirement. However, test values ranging from 4% rated current to several times rated current have been obtained at 125% rated voltage. The extremely high magnetizing currents (which are comparatively rare) are indicative of high magnetic flux density core designs. At 125% rated voltage there is probably little difference between the magnetized current requirements of the old hot-rolled steel core designs and the newer cold-rolled steel core designs.

At 75% voltage, a modern power transformer of the rating discussed should be expected to have between .05% and 1% exciting current and at 100% voltage the exciting current should be 2% to 2½%. It should be noted that standards do not require a power transformer to meet established temperature rises when operated above 110% rated voltage at no load. No special provision is required by the transformer standards to meet this overvoltage no-load condition.—G.W.W.

ANSWER TO Z33—The estimated no load loss would be 2400 watts. Since the power factor is very low on an idle transformer the reactive volt amperes would be roughly about five times the loss or about 12000-volt-amperes; at 75% voltage about 9000-volt-amperes; at 125% voltage about 15000-volt-amperes. —E.B.

ANSWER TO Z33—Normally the exciting current of a transformer is somewhere between 1% and 3% of the normal full load current. This exciting current is composed of two components: the magnetizing current, which is in quadrature with the applied voltage and the energy component of the exciting current which is in phase with the applied voltage. In most commercial transformers the phase angle between the exciting current and magnetizing current is very small. Therefore in this case the magnetizing (or exciting) current would be somewhere between 2.5 and 7 amps on the primary of the 2400-volt transformer. The kvar meter should read somewhere between 6 kvar and 16 kvar depending on the magnitude of the exciting current.

It would be difficult to say what values to expect at 75% voltage and 125% voltage without having core loss and saturation curves of the transformer. The core loss will vary almost as the square of the voltage and at 75% of rated voltage the magnetizing current will vary approximately in direct ratio with the voltage. However, at 125% of rated voltage the knee of the magnetizing current curve has been passed; i.e., the magnetizing current increases rapidly with only a very small change in voltage, making it very difficult to say what readings to expect on a kvar meter at 125% voltage.—H.R.W.

Heat Affects Motor Overload

QUESTION A34—In our plant we have 3-phase 440-volt motors that operate in warm locations. The thermal overcurrent devices for these motors are located in cooler places. Will motors operating in warm locations pull more current than motors operating in normal locations?—L.R.S.

ANSWER TO A34—The object of using thermal overcurrent relays is to protect the motor from overload and burn out on the basis of total motor temperature. The principle behind application of replica thermal overload devices assumes that the relay and the motor are both operating with the same ambient air temperature. Then since the temperature rise in the device heater will be proportional to the line current causing heating in the motor, the overload device will remotely sense total motor temperature. The overload device will then trip the starter contactor if necessary to prevent motor overheating under overload conditions causing high current draw.

If the motor is located in a warmer ambient than the controller, the replica thermal overload relay will still have a temperature rise proportional to the motor current and the motor temperature rise. However, since the overload device started from a lower initial temperature than the motor, its total temperature will also be lower than the total temperature of the motor so it cannot adequately protect the motor against dangerous overheating.

As far as the motor itself is concerned the current is proportional to load and is not affected by motor or ambient air temperature. If the temperature difference between the motor and controller locations is fairly constant, it can be taken into account in selecting overload relay heaters and I would recommend that the manufacturer of the equipment be consulted for a specific recommendation.—L.D.B.

ANSWER TO A34—Conductor insulation has a safe permissible maximum temperature. If this temperature is exceeded, the insulation will deteriorate and ultimately fail. Rated current I of an apparatus is based on an average ambient, and the maximum safe permissible temperature: the losses, I^2R, raise the temperature from ambient to the safe maximum temperature. If the ambient is below average (cold climate, cold location) the apparatus can be up-rated. If the ambient is above average (hot climate, hot location as in your case) the apparatus must be de-rated. Overcur-

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Here's Bill Lisch, who will tell you that there's extra profits to be found in most jobs—if, at the start of the job, the electrical contractor just recommends the additional services his customers need. And that's how he added a fire warning system to the renovation job pictured here.

William N. Lisch is a Milwaukee electrical contractor who is greatly aware of the fire detection problem. Here he examines a "heatguard" thermostatic detector unit in ceiling of basement garage of lake front mansion, being renovated as doctors' offices, clinic, and living quarters for owner Dr. Ralph P. Sproule, *center* in photo below.

"Renovation or remodeling is one of the best times to recommend services like fire detection," says Bill Lisch. "It's a time that seems to be psychologically right, when the customer is most willing to consider products that might otherwise meet some sales resistance. This is especially true of residential work." And Lisch points out that the customer saves money when an "additional" item is installed right along with the basic renovation work.

"Early installation is especially desirable for a fire warning system," Lisch adds, "to give the customer extra protection during the rest of the renovation work, when the possibility of fire is bound to be higher than normal." Lisch's point is illustrated by the materials beneath the scaffold in the picture above, where one of his men is installing another of the "heatguard" detector units. The complete Edwards *Zonalarm* system Lisch installed uses these heat detectors in four separate fire-warning *zones* to locate overheating instantly in fire-prone places throughout the building.

"Find out the product or service the customer can see he needs," says Lisch, "and you'll run into surprisingly little sales resistance. Because Dr. Sproule will have his living quarters on the second floor of his completed clinic building, *Zonalarm's* instant fire warning is doubly necessary 24 hours a day. And because I was recommending needed service and protection, Dr. Sproule was not concerned about the cost when he agreed to the installation."

"With some products you can call on the manufacturer's salesman if you need information or sales help," Lisch advises, "and again this *Zonalarm* system is a good example." Here, with Edwards salesman Joe Parry, Lisch goes over the Zonalarm power unit and emergency reserve power supply installed in the basement of Dr. Sproule's clinic.

The heart of the *Zonalarm* system is the main indicator panel, located in the living area on the second floor in this installation. Fire would sound the warning here, and show its location in one of the four *zones* by a lighted indicator on the panel. Contractor Lisch looks on as Joe Parry demonstrates to Dr. Sproule how at any time you can test the complete *Zonalarm* circuit from the main panel.

"Before this installation was completed, it had led to another sale of a Zonalarm system," says Lisch, "this time a purely residential installation." The ready availability of Edwards Zonalarm through electrical wholesalers, and its great flexibility, enable contractors to meet varied residential, farm, and commercial fire warning needs. Here Lisch points out the Edwards Adaptahorn®, a distributor stock item installed next to the clinic's garage as an extra accessory to sound an outside warning.

The Edwards Company believes that contractors have an important but sometimes under-rated job to do in the electrical industry. Often we run across men in contracting, like Bill Lisch in Milwaukee, who are doing their job very well indeed. We're glad to be able to relay their ideas.

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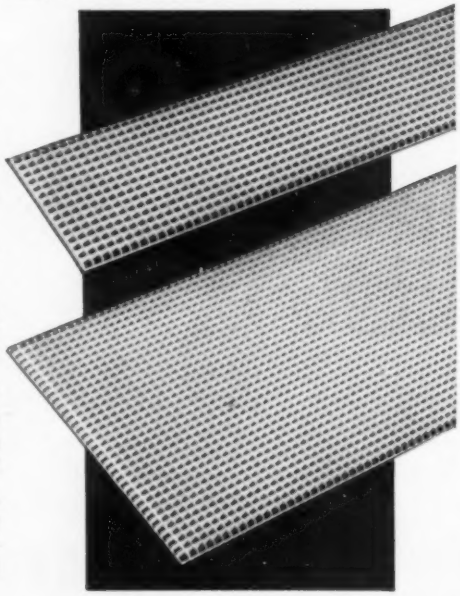

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rent devices will protect only when they are at the same ambient as the apparatus they are supposed to safeguard. Specifically, if they are at a lower ambient than the motors, the current which will operate the device will overload the motors.—L.F.R.

Capacitor Size For Motor Starting

QUESTION B34—What is the correct capacitor size to be used on specific motors for starting purposes? I have reconnected a 3-phase (220-440) motor to run single phase on 110-220 volts. It draws 4.5 amps on 220 single phase. I wish to use the capacitor in the starting winding only. Starting winding has only one-half the groups the running winding has.—E.H.

ANSWER TO B34—Since the motor you have reconnected draws 4.5 amps single phase at 220 volts, 4.5 would be called the single phase equivalent of the 3-phase motor current. The line current of the 3-phase motor would be 4.5/1.73 or 2.6 amps. This indicates that you re-connected a ¾-hp, 3-phase motor.

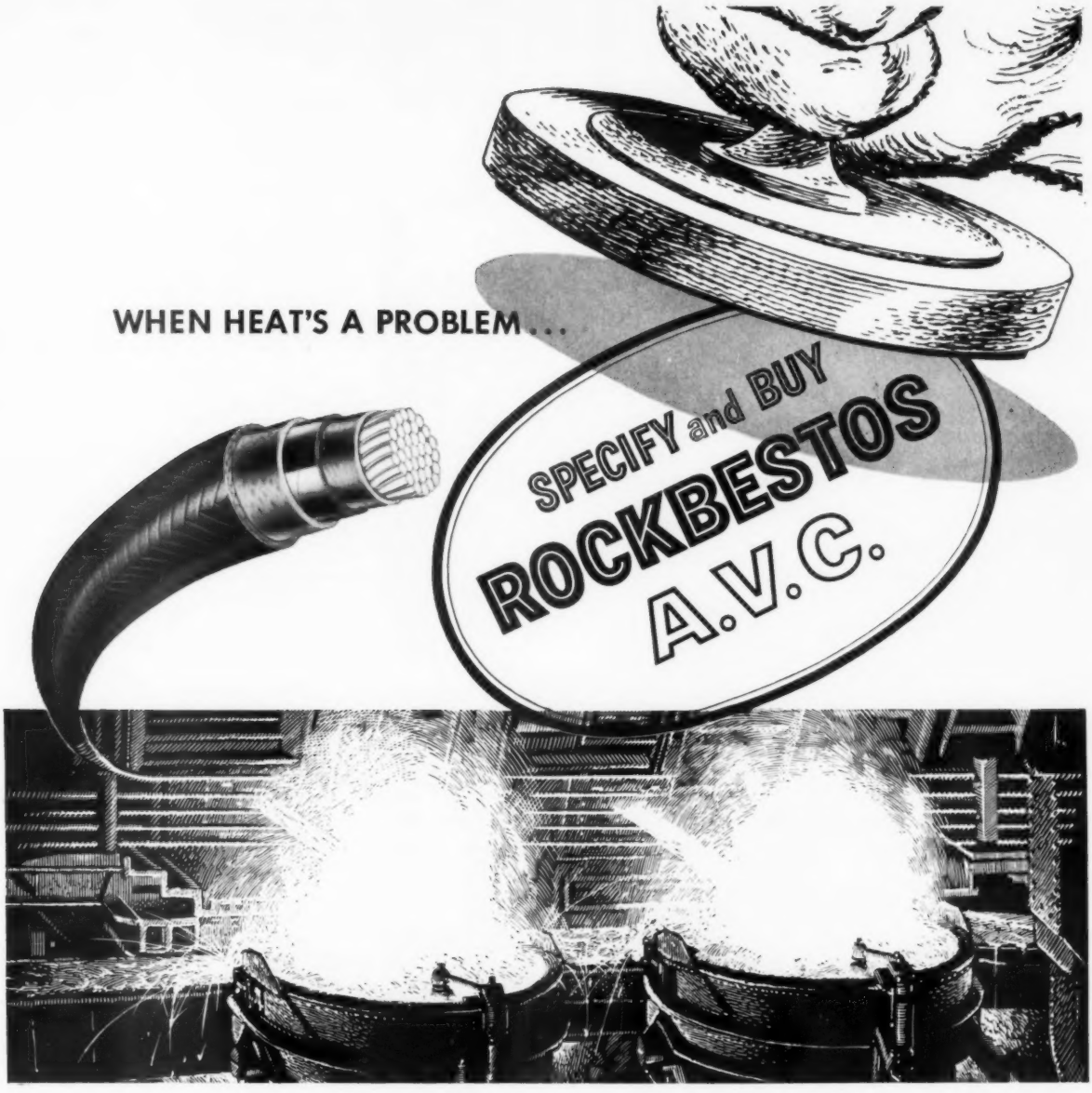
Since the 3-phase stator winding carried 2.6 to 2.8 amps, the same coils when used in the re-grouping should carry only 2.8 amps and would need other field coil windings in parallel to safely carry the 4.5 amps if you desire the motor to deliver full hp.

The windings of the single phase motor cannot be considered standard and comparable to the windings in the various makes of capacitor motors which makes it impossible to choose with certainty a capacitor for your motor that will produce the highest torque.

Makers of capacitor motors do not necessarily use the same MFD capacity for the same hp motor.

The best way to determine the torque is to lock the rotor with an arm which would operate a platform or spring scale, or tie a rope to a pulley on the rotor shaft to operate a spring scale and install capacitors having various MFD capacities until you find one that produces the highest torque.

If it is necessary to buy several capacitors, it might be less expensive to buy a C.D. senior "Service Mike" from Cornell Dubilier Electric Corp., South Plainfield, N.J. This capacitor called "Service Mike", has four terminals to which connections can be made to supply capacity in steps from 37.5 MFD



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The torque will increase very rapidly as you add capacity until you reach a maximum at which point more capacity will cause a slight decrease in torque. By this method you can easily determine the capacity to produce the highest torque.—B.A.S.

Voltage for Motor Testing

QUESTION C34—What voltage is impressed on motors to determine a good test potential, or is a test potential determined by the input voltage of a motor?—E.H.

ANSWER TO C34—High-potential test values which were used on thousands of motors over many years is as follows:

For newly rewound motors:
(2E plus 1000) = T.P.
For reconditioned motors:
.66 (2E plus 1000) = T.P.

Where E is the nameplate volts of the motor and T.P. is 60 cycle ac applied for one minute.

However, direct current high-potential tests are now being used to a great extent, due to non-destructive effects of direct current tests, and the ability to predict probable voltage at which dielectric failure will occur.

With direct current high-potential tests, we plot graphs of current leakage in micro-amperes versus applied test volts, and sharp non-linear increase in micro-amps leakage current indicates approaching dielectric failure. With direct current, the test voltages used are 1.6 times that used with alternating current.—L.N.W.

ANSWER TO C34—The rule for testing electrical equipment is twice rated plus 1000 volts for a period of one minute. Thus a 550-volt motor should be capable of withstanding 2100 volts ac for a period of one minute.

However, many people find it easier to use an insulation tester which operates at dc. The common one delivers 500 volts dc and actually measures the insulation resistance. Then, if this resistance is up in the tens of megohms, the equipment is considered to be in good condition.

I should like to stress that such a test is actually meaningless. Insulation resistance is definitely a non-linear property of materials. And insulation which may have

A supersonic fury, the Air Force's all-weather F-102 is shown with auxiliary power unit connected which can feed up to 250 amps at 28 volts for starting power and also to energize the electrical system for maintenance procedures; thus relieving strain on aircraft batteries. Twin, parallel type Okocords are widely used to connect auxiliary power unit to aircraft.

Surer starting, time after time

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On today's supersonic fighting craft, an auxiliary power unit is used to energize the plane's electrical gear while it's on the ground . . . and to feed in the extra jolt of juice needed to start it on its skyward lunge.

Okocord cable is widely used for this critical chore. It stands up with unfailing dependability to being dragged along concrete runways . . . to being left for hours on end in water and oil . . . to wide variations in temperature . . . to being run over by various airstrip vehicles.

Twin parallel Okocord

From any standpoint: reliability, flexibility, strength and extra long life—Okocords are the best bet to end your portable cable problems once and for all. Facts, figures and specifications in free Bulletin EC-1108, The Okonite Company, Passaic, New Jersey.

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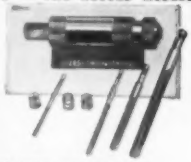

*By actual job tests, compared to drilling with carbide tipped bits.

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high resistive values at 500 volts dc, may be quite useless at 2100 volts ac.

Consider the following: 2100 volts ac has a peak value roughly 40% higher than 2100, i.e., almost 3000 volts. Furthermore, the impact value of this voltage is much worse than a steady 3000 volts dc, insofar as its effect on the insulation is concerned. Actually experience has shown that depending upon the type of insulation, etc., 2100 volts ac may be equated to anywhere between 2500 and 3500 volts dc. An exact comparison is difficult, as insulation differs very widely in properties, and also aging has a strong effect. As a working minimum therefore, I would recommend either the ac test, or at least 2500 volts dc for any apparatus up to 600 volts.—H.H.S.

Protective Wrap On "R" Conductors

QUESTION D34—In a recent job that was put in service, we had to insulate Type R 500 MCM's with asbestos tape and paint the asbestos with soda of silicate. The wires are in troughs and in a very hot room. What is the purpose of soda-silicate?—V.S.

ANSWER TO D34—The soda-silicate is used to prevent moisture and conductive dust from entering the asbestos pores. It also makes the asbestos more abrasion resistant. —H.S.

ANSWER TO D34—In a very hot room, Type R insulation will deteriorate and eventually crack and crumble. While the asbestos tape would effectively insulate, it does not possess sufficient strength to prevent the conductors from breaking through the disintegrated rubber insulations and the asbestos tape itself and causing a short circuit or a ground.

Applying soda-silicate (waterglass) would provide a homogeneous layer over the asbestos tape for much increased physical strength, more electrical and hot insulation, and also act as a moisture repellent in the event that the very hot room should be shut down for a period of time and possible condensation should set in.—J.J.R.

ANSWER TO D34—Before the advent of "flame-retarding compound" on rubber insulated cables, municipal codes provided for asbestos tape or sleeving over the cables in main switchboard pull boxes, troughs, etc. If the asbestos sleeving or tape gets wet or absorbs moisture it is very difficult to dry out. Consequently sodium silicate or otherwise known as waterglass was applied to the asbestos by the use of a paint brush. However, it is not generally known that waterglass if it absorbs moisture and comes in contact with the bare ends of a conductor or touches a lug it will carry current thus creating a hazard. As a result the use of asbestos sleeving should not be used. Instead at a slightly additional cost fibre glass tape or sleeving should be applied.—D.F.

Can You Answer These QUESTIONS

QUESTION N34—Our plant has an extensive conveyor system powered with ½ and ¾ hp, 3-phase, 220-volt standard induction motors which are controlled by photoelectric eyes on a start-stop duty cycle. These motors are equipped with magnetic brakes and it would be desirable to control the motor acceleration and deceleration to give smooth starting and stopping. Can someone suggest a practical economical method for accomplishing this.—R.E.B.

QUESTION P34—Is it possible to pass sufficient current through a single No. 6 insulated conductor in a ½-in. conduit imbedded in a concrete driveway to be able to melt the ice and snow on the driveway? Can some one throw light on this subject matter?—J.A.M.

QUESTION Q34—Can the primary and secondary wires between a wound-rotor induction motor and its controller be installed in the same conduit?—G.J.P.

QUESTION R34—I have been told that dc electrolytic capacitors must be connected with the marked polarity because they act as a short or very low resistance in the reversed direction. If this is the case, how can a true reading be obtained with a commercial tester that we have that uses ac to test all types of capacitors?—R.J.S.

PLEASE SEND IN YOUR ANSWER BY JULY 15

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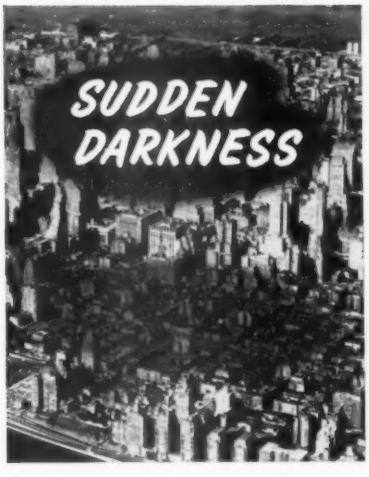

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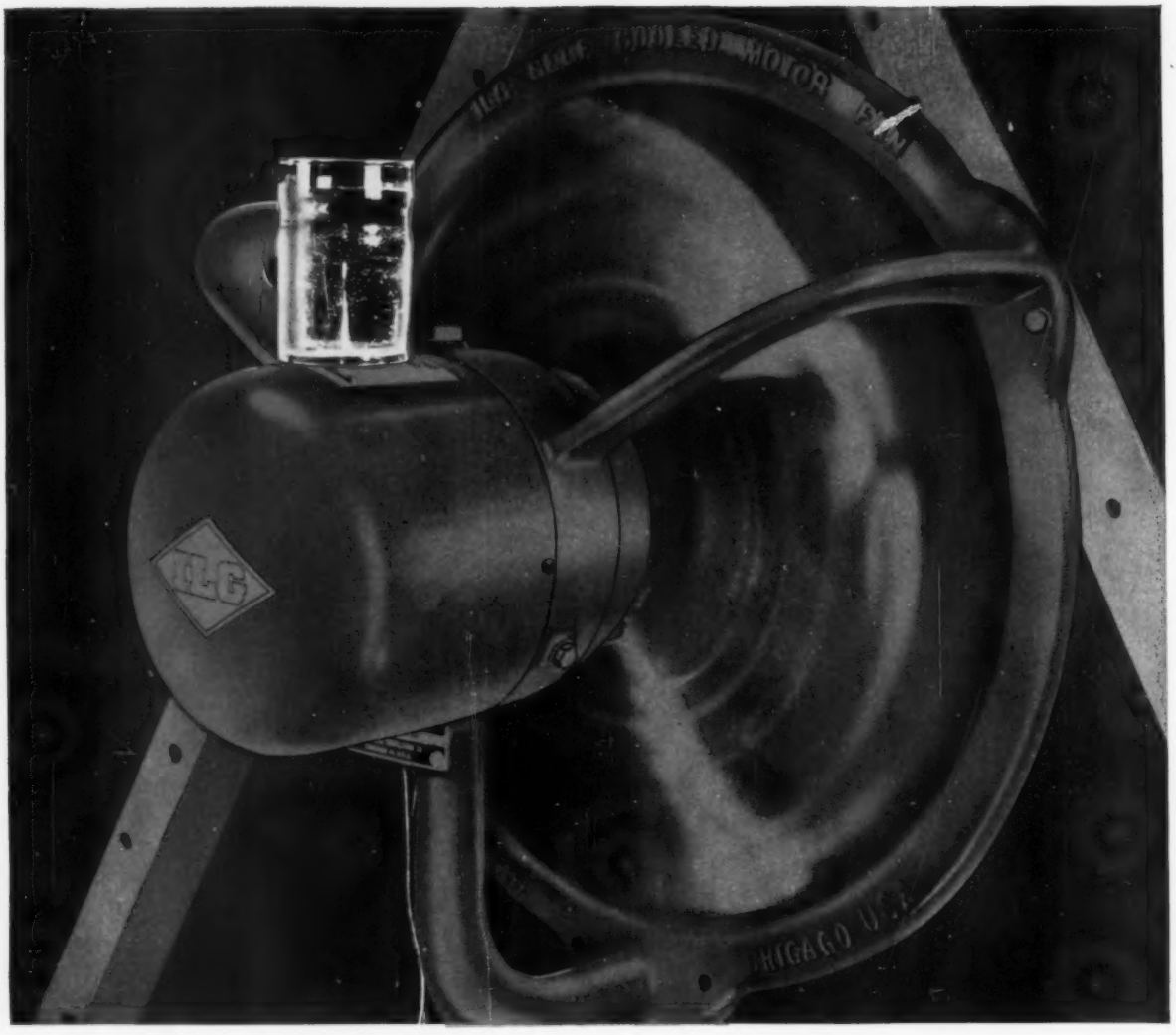

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Questions on the Code

Answered by:

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
GLENN ROWELL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*

Approved Service Equipment

Q. *I read many of your articles in Electrical Construction and Maintenance, and I believe your opinion as a code authority will add much interest concerning the subject now under discussion with some consulting engineers. The use of service equipment, not properly labelled, is extensive with some contractors. They install it and then the customer puts the pressure on the utility and inspector for service. I have criticized such procedure and am enclosing copy of my letter to the consulting engineer involved outlining my position in the matter. Will you kindly comment on this subject?—H.B.S.*

A. As you say, Section 2351-a of the N. E. Code requires the service disconnecting means to be of a type approved for service equipment. The Underwriters laboratories' list several manufacturers who are able to produce such approved service equipment. See pages 289-291 of the UL Electrical Construction Materials List. Such UL approved equipment bears a label of three different forms depending upon the rating of the equipment. The first is 30 amps, the second 31-100 amps and the third 101 amps and up. At the present time, there are 42 different manufacturers who are listed by UL to furnish service equipment labels, and I note one of them is located in your city. I mention the foregoing to show that this rule calling for approved service equipment is widely recognized and enforced in various sections of our country.

My personal reaction to the rule may be briefly summed up as follows:

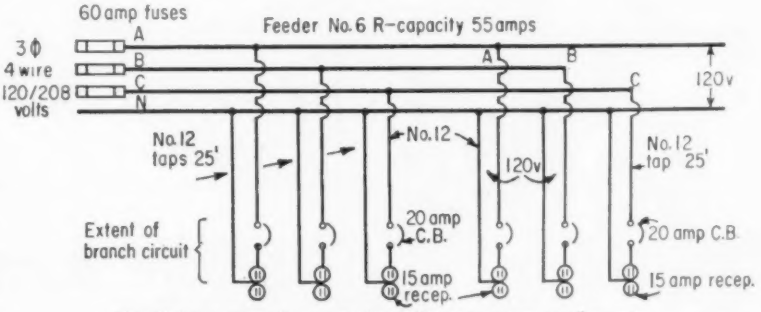
When the code specifically requires service equipment to be approved, and Underwriters' Laboratories sets up standards, conducts tests and furnishes a label service covering the design and construction of such equipment, it appears to me that anyone who is concerned with the installation, such as the architect, engineer and contractor, should welcome such service which shares the responsibility involved. Any electrical inspector who is responsible for enforcing the code should insist on the installation of UL approved materials and devices. While he is authorized by the code to determine the word "approved", he ordinarily is not qualified to pass judgment on the safety of a device such as a main disconnect. He has no laboratory and he may not have a clear understanding of the factors and hazards involved with the design. This is the principal reason why the UL was established and any inspector who discounts the importance of this service and assumes the full responsibility for the term "approved is, in my opinion, foolish. Accidents do happen, equipment fails, faults occur which in some cases result in personal injury or fire. Sometimes such cases are brought to court and the inspector, engineer and contractor, who have discounted the importance of UL approval, will find themselves in a difficult position when they face the judge to prove that they have not been negligent.—B.A.McD.

10- and 25-Foot Tap Exceptions

Q. *In the October issue of Electrical Construction and Maintenance, B. A. McDonald answers a question regarding the logic of the 10- and 25-ft tap exceptions in the National Electrical Code and I was pleased with Mr. McDonald's answers that these exceptions to the fundamental rule contained in the first sentence of Section 2434 are just that and should not be considered as general rules of the code.*

I recently criticized a proposal to run a No. 6 feeder through a building, protected by a 60-amp fuse, to which was connected several 25-ft taps of No. 12 wire which terminated in a 20-amp circuit breaker and a 15-amp receptacle. I criticized this proposal on the basis that the 25-ft tap covered by Section 2434-d was an exception to the fundamental rule which never was intended; and the miscellaneous scattering of branch circuit overcurrent devices is contrary to the fundamental rule of Section 3808 which requires switches and circuit breakers, insofar as practicable to be grouped. Will you kindly comment.—J.F.G.

A. The 25-ft tap provision of Section 2434-d first appeared in the 1931 code, and was taken from a similar rule which applied only to motor branch circuits as covered in the 1925 code. In other words, Section 2434-d is about 26 years old, and I doubt if the Electrical Committee at that time considered the application under discussion, or had any idea of including it within the scope of this Section. Reference to the 1931 analysis of the changes made in the 1931 code by Mr. Abbott appears to indicate that the rule applied to feeders and sub-feeders connected to same, such as a 25-ft tap run to a panelboard or a switch. In addition to the foregoing, the 25-ft tap rule is an exception to the fundamental rule which requires an overcurrent device to be located where the conductor to be protected receives its supply, and if we continue to distort the intent of the excep-



Circuit breakers and receptacles adjacent to one another, or a combination of both in one box.

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The bottling and handling of propane gas requires care and caution every step of the way—including safe, spark-free electrical fittings and lighting fixtures for the areas that are to serve it. To fill the need for quality-you-can-count-on fittings, the Ruby Propane Gas Co. of Effingham, Ill. chose the Killark line for installation throughout their plant.

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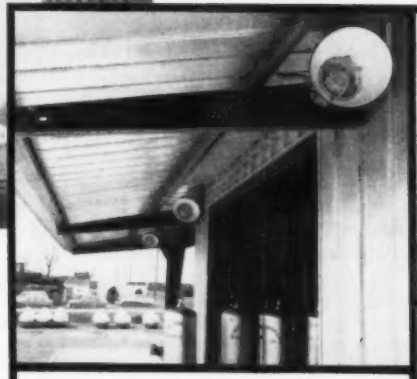
Ralph Hinchman, St. Louis, Mo.



Two scenes of the Ruby Propane Gas Co. loading dock, safely lit for night use with Killark Explosion-Proof fixtures.

In the background of this close-up of a tank of propane gas stand several Killark "sentinels of safety": Killark explosion-proof switches, explosion-proof receptacle and a seal-off fitting.

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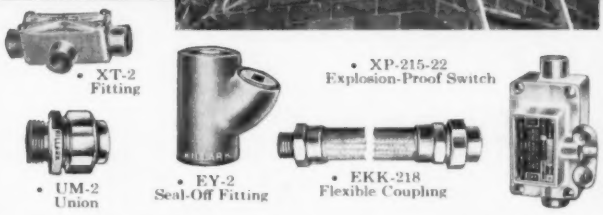
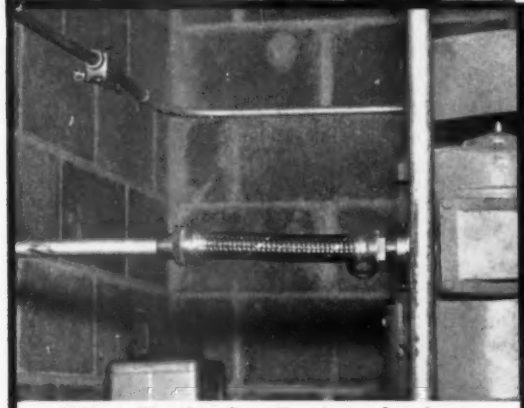


Mr. Vic Sarin of Sarin Elec. Co., looks on as a member of the E. F. Houghton Co. points to several Killark fixtures used to connect a pump installation.



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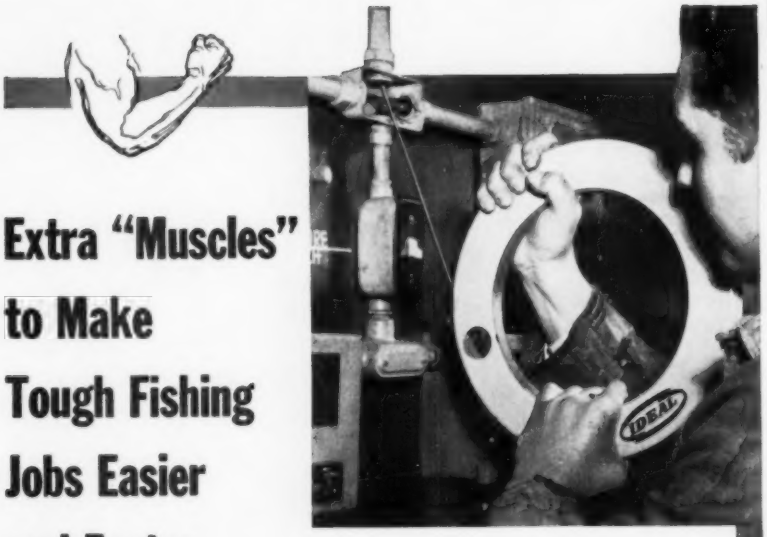

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tion, we possibly may find a way to eliminate the need for panelboards.

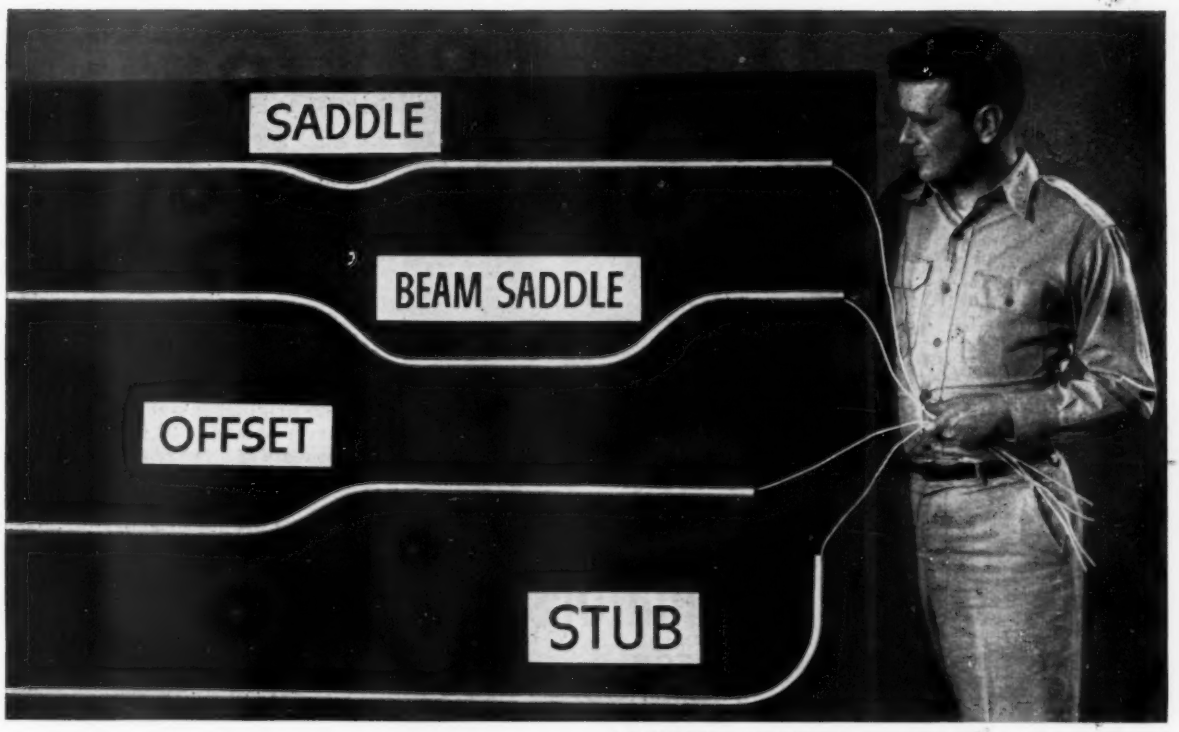
For the benefit of our readers, we have shown by illustration a 3-phase 4-wire feeder consisting of No. 6 type R conductors protected by 60-amp fuses, which according to the proposal is to run through the building. To this feeder several 25-ft. taps of No. 12 wire are made which terminate in a circuit breaker and a receptacle. As far as a literal reading of Section 2434-d is concerned, there appears to be no code violation. There is however a question of code intent. It is quite obvious that there is practically no branch circuit wiring other than the unprotected 25-ft tap and such a combination is not recognized by Article 210 covering branch circuits. It also appears obvious that the provisions of Section 3808 which requires circuit-breakers to be grouped, and Section 2436 which requires overcurrent devices to be enclosed in cutout boxes or cabinets, are violated. In addition to the foregoing, general acceptance of this proposal will result in thousands of feet of conductors which are overfused 300% when overcurrent devices are not installed where a change in wire size is made. The situation is the same which now prevails on motor branch circuits where the conductors are overfused 300% to 400%. In the case of motor circuits however, there is substantial reason that justifies the procedure, but in the case under discussion I know of no good reason why the receptacles in question should not be served through branch circuits protected by overcurrent devices located in a panelboard.—B.A.McD.

Grounding Range Components

Q. *Article 2560 of the National Electrical Code states that frames of electric ranges and electric dryers may be grounded by connection to the grounded circuit conductor.*

Are the built-in type of ranges consisting of a built-in oven and a built-in surface unit considered a range which may be grounded in this manner? The oven and the surface cooking units are to be fused and fed separately with No. 10 wire.— A.G.

A. Section 2560, as it pertains to electric ranges first appeared in the 1946 code. At that



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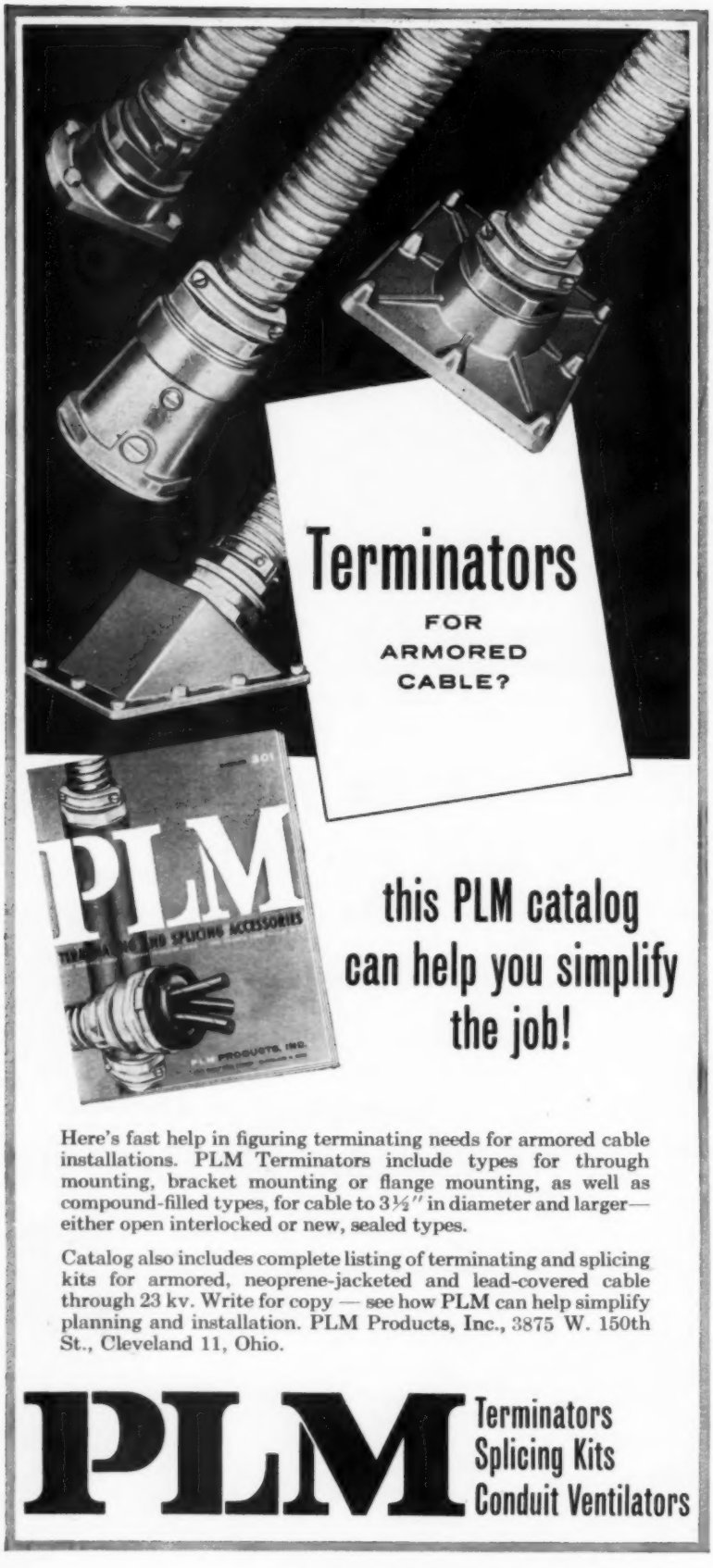
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time the term "electric range" was understood to mean an assembly of an oven or ovens and surface-cooking units mounted in a single frame. With this thought in mind the code recognized the grounding of the frame of an electric range to the grounded circuit conductor. This was the thought when the rule was formulated and no consideration was given to the situation which has developed within the past few years where the various components of an electric range are installed as separate units in various locations in the kitchen. As a result of the foregoing I personally believe that the original intent of Section 2560 never intended to include the components of a range as coming within the scope of this code rule.

The components of electric ranges are listed under the general heading of Ranges in the Electrical Appliance and Utilization Equipment List of Underwriters' Laboratories, page 130, with the following notation:

"These components are considered as individual units intended to be supplied from individual branch circuits."

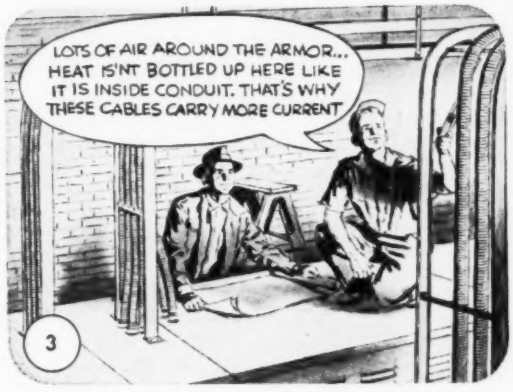
This advice indicates that there is a distinction between a range and a component of a range, and so long as this distinction prevails, we should not consider the grounding of the component to the grounded circuit conductor. I understand however that this question and others which concern the wiring of range components is being studied, and it is quite possible that the 1959 code will specifically cover the question you have raised.—B.A.McD.

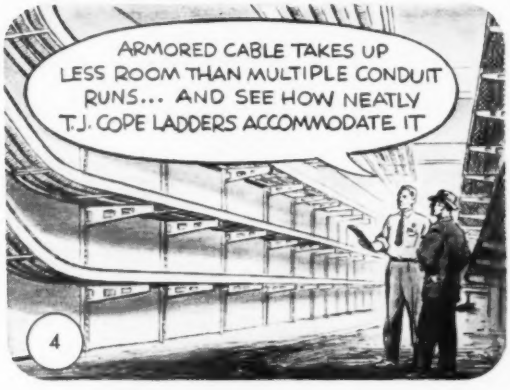
Type NM Cable—Outside Masonry Walls

Q. *In South Florida, adjoining county inspectors seem to disagree on the usage of non-metallic sheathed cable in residential wiring. Weather conditions which may affect this usage, I may point out, are practically identical. Our home county accepts, as do inspectors of municipalities, non-metallic cable (Romex) stapled to ¾-in. treated furring strips which are nailed to outside CBS walls, over which rock lathe and plaster is used as the finishing material.*

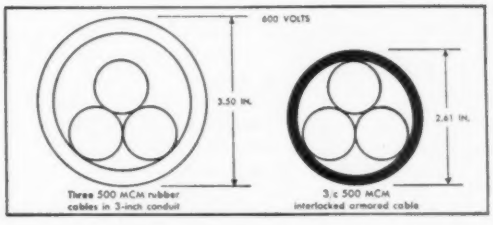
In the adjoining county, inspectors including municipalities will accept non-metallic sheathed cable on outside walls, as mentioned above, only if it is pulled in EMT

ROMAN ARMOR'S BEST...


LOTS OF AIR AROUND THE ARMOR... HEAT IS'NT BOTTLED UP HERE LIKE IT IS INSIDE CONDUIT. THAT'S WHY THESE CABLES CARRY MORE CURRENT
3



A matter of FACT



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or conduit. This practice seems to be a protector against moisture rather than against mechanical injury. We would appreciate very much your interpretation of the intent of Article 336, paragraph 3362-A, since we feel that the National Electrical Code would not require the protection called for by the adjoining county inspectors, inasmuch as they claim that that is the basis for their requirements.—H.M.

A. Section 3362-A of the code recognizes the use of Type NM non-metallic sheathed cable for both exposed and concealed work in normally dry locations. As an example, some cellars may normally be dry but occasionally are considered damp for short periods of time due to weather conditions. Type NM cable may be run or fished in air voids in masonry block or tile walls where such walls are not exposed or subject to excessive moisture or dampness. It is my opinion that an outside wall is subject to excessive moisture and dampness, while an inside wall is not normally so exposed. In support of this opinion, I have seen panelboard enclosures mounted flush in outside masonry walls completely eaten away by the corrosive influence associated with such outside walls.

Concrete blocks, in addition to their cement content, contain aggregates including sand and gravel, cinders, blast furnace slag, burned shale, pumice, etc. Cinders exposed to moisture produce sulphuric acid which in turn increases the corrosive effect. Condensation and humidity also are contributing factors to excessive moisture and corrosion.

In view of the foregoing, it is my personal opinion that unprotected Type NM Cable should not be used in an outside wall as described in your question. Section 3362-B recognizes a Moisture and Corrosive-Resistant Type NMC cable which is suitable for use in moist, damp, or corrosive locations, and is specifically recognized for use in outside and inside walls of masonry block or tile. The fact that this section of the code specifically recognizes the use of Type NMC in an outside wall may be taken to infer that Type NM cable is not so recognized.

Previous to the development of Type NMC cable, which was first recognized in the 1953 Code, I recall several inspection authorities in the North required the original Type NM cable, installed in an outside masonry, to be protected by

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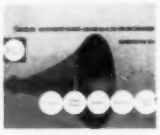

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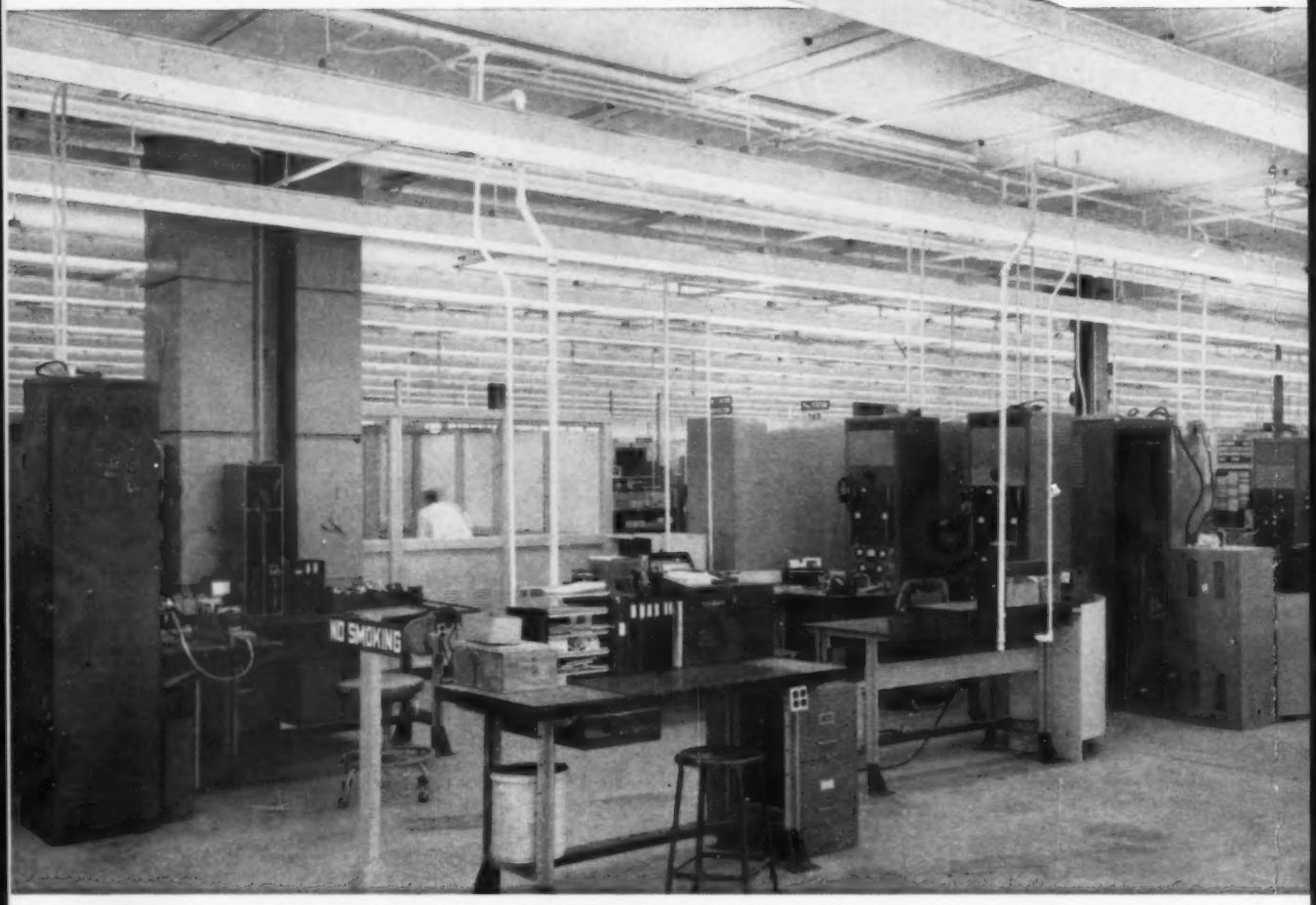

Day-Brite CFI-25L fixtures lower ceiling contrast with 25% upward lighting . . . have hinged louvers for 30°-20° shielding . . . furnish 100 footcandles at work level in the Electronic and Accessory Shop at United Air Lines' Maintenance Base, International Airport, San Francisco. H. J. BRUNNIER, *Structural Engineer;* LYLE E. PATTON, *Consulting Electrical Engineer;* EMIL J. WEBER ELECTRIC CO., *Electrical Contractor.*

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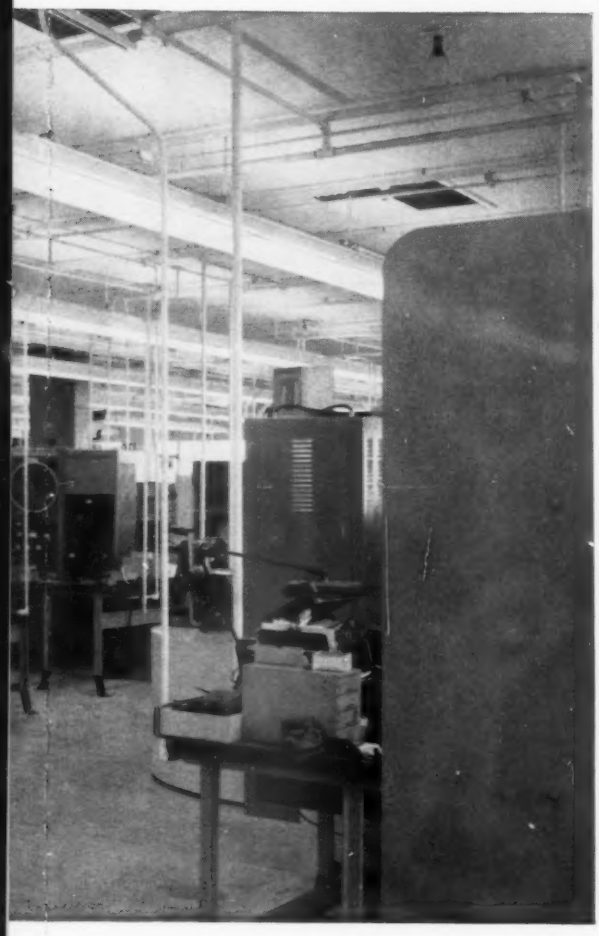

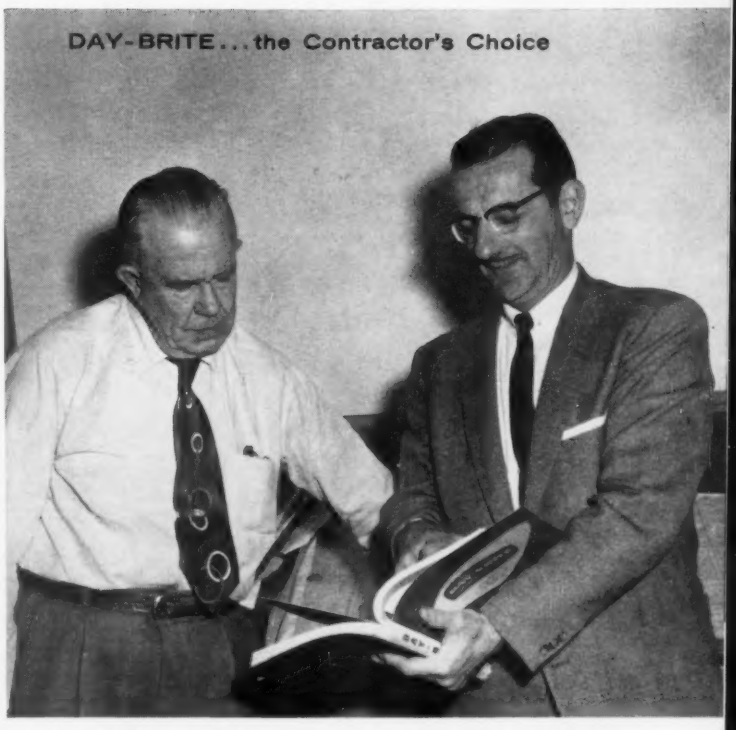

EMIL J. WEBER (left), President of the San Francisco Chapter of NECA, chats with JAMES L. DELLOS.

"Day-Brite is easy to work with..."

—says Jim Dellos, Manager
Emil J. Weber Electric Co.
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"In the case of Day-Brite, both the *company* and the *product* are easy to work with.

"Fixtures are shipped to arrive on the job when needed. This coordination of deliveries with our schedules requires close cooperation between the factory, representative and our superintendent on the job. And Day-Brite never lets us down!

"And that goes for Day-Brite fixtures, too. They go up easy, and line up fast . . . *accurately*. Even with less experienced help, Day-Brite fixtures can be installed properly with less supervision.

"Day-Brite service and quality help us operate more efficiently and economically. That's why we're *sold* on Day-Brite, the standard of the lighting industry."

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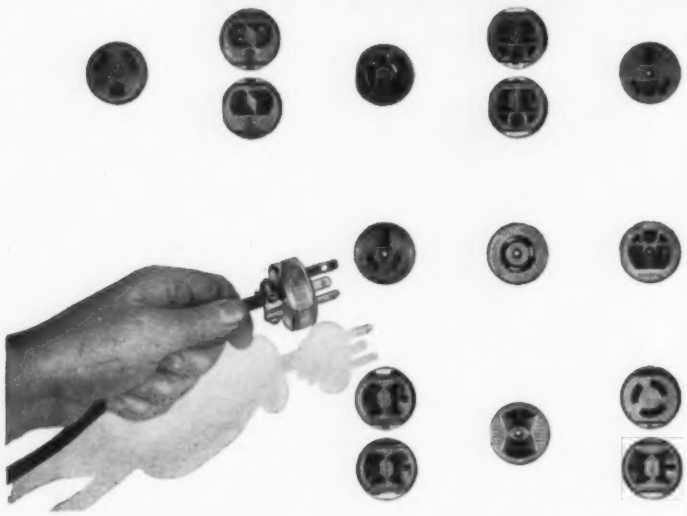


SAFELETS

now available with a wide variety of receptacles and circuit breaker ratings

The Heinemann Safelet is a compact unit that neatly combines circuit-breaker safety with plug-in convenience. It has hundreds of applications, can be used for the individual protection of power tools, fractional horsepower motors and almost all general appliances.

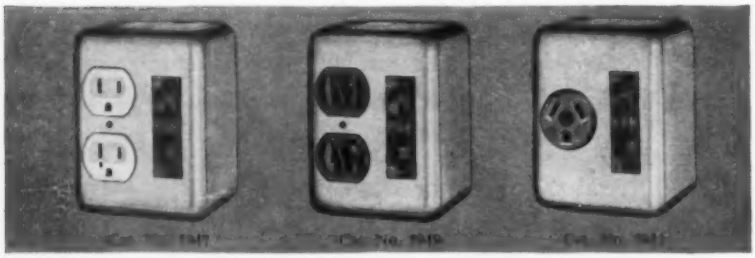
Now you can have the Safelet with any of a large number of receptacles, single and duplex, in twist-lock, polarized, "T" slot and other styles.

And now you can have a wide choice of circuit breaker ratings: from 6 to 50 amperes, at the most commonly used a-c and d-c voltages.

The Safelet enclosure is made of 16-gauge steel with an attractive grey hammertone finish. Units are available for either flush or surface mounting.

Of course, the circuit breakers used are Heinemann breakers . . . long accepted by the electrical industry as the standard of performance.

For full details, send for Bulletin 1000.



HEINEMANN

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conduit. In some cases armored-cable lead was used. The development of Type NMC cable however eliminated the occasion for such procedure, and I believe it could be used in your state without any question of N. E. Code violation.—B.A.McD.

Fixture Mounting

Q. *In Section* 4184 *pertaining to mounting fluorescent fixtures on low-density cellulose fiberboard, what is meant by approved for the conditions?—B.B.*

A. Approved will mean that some recognized authority will be able to take fixtures purportedly designed for such conditions of installation, test them under such conditions of installation and as a result of such testing label, list or otherwise give evidence of proper performance of these fixtures for such installation conditions.

In general, Underwriters' Laboratories, Inc., has in the past been accepted and recognized as a fully competent and reliable source for such testing, and labeling or listing of such fixtures by them would be entirely acceptable. To the best of my knowledge no fixture as yet has been approved by the UL (or for that matter by any other testing organization) for such installation. So for the time being all fixtures so installed will have to be mounted so as to have a 1½-in. space between the fixture and the surface of the fiberboard.—B.Z.S.

Calculation Load—Branch Circuits

Q. *Section* 2116 *of the code reads, in part, as follows: "When in normal operation the maximum load of a branch circuit will continue for long periods of time, such as store lighting and similar loads, the minimum unit loads specified in this section shall be increased by* 25% *in order that the wiring system may have sufficient branch circuit and feeder capacity to insure safe operation."*

It is stated, on the basis of test, it takes a normal current on a correct size conductor about three hours to reach the operating temperature. That is a long period of time, and when do you apply the 25%*? We believe the code should*

PROVE IT FOR YOURSELF. CM-OT finish (left), with helically-wrapped corrugated bronze tape, withstands compression to a much greater degree than a Parkway-type finish with a flat metal tape twice the thickness (right).

CM-OT* gives more compressive strength with half the thickness of metal tape

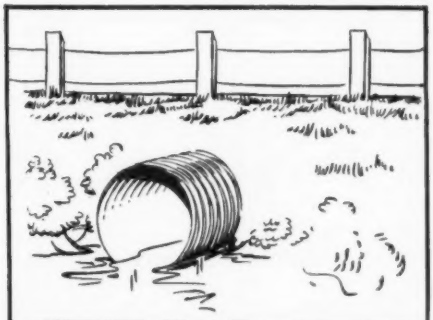
Now you can have a high strength cable covering without resorting to bulky or hard to train direct burial constructions. Okonite CM-OT covering provides a light weight, flexible, small diameter cable of great compressive strength. It offers an excellent combination of installation and maintenance savings for many types of cables—control, communication, power or lighting.

Originally designed for direct burial, CM-OT cables are also readily installed aerially, in conduit, in racks or in underground ducts . . . permitting you to stock one type of cable for many uses.

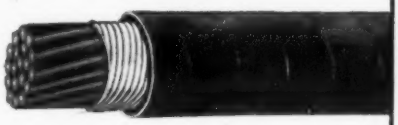
The corrugated bronze tape that's the heart of the cable covering is permanently bonded to a tough wall of Okoprene, with an Okoprene-filled tape applied overall. This composite covering—bronze plus neoprene—provides a barrier against rodents, termites, moisture, oils or sunlight as well as corrosion by soil alkalies and acids. CM-OT also acts as a two-way cushion and "shield" against the stress of shifting stones and mechanical impact that might damage the vital conductor insulation in service. Electrically, the bronze tape serves as an excellent shield, and "ground" where necessary.

Where your environmental conditions demand different corrosion-resistant properties, CM-PF finish is available with Okoseal (polyvinyl chloride) or Okolene (polyethylene) bonded to the corrugated bronze tape instead of Okoprene. This should be considered particularly where petrochemicals are present.

Flexible . . . easy to handle, splice and terminate—CM-OT is a quality construction you'll find it profitable to become better acquainted with. For the full story, including actual test figures on the samples in the photograph, send for Bulletin EC-1121, The Okonite Company, Passaic, New Jersey.



Corrugation = strength plus lightness
Just as corrugated construction adds strength to underground pipes, so corrugation of shielding tape permits the construction of a stronger, lighter, more flexible and more easily handled cable—CM-OT.



*Patent No. 2722562

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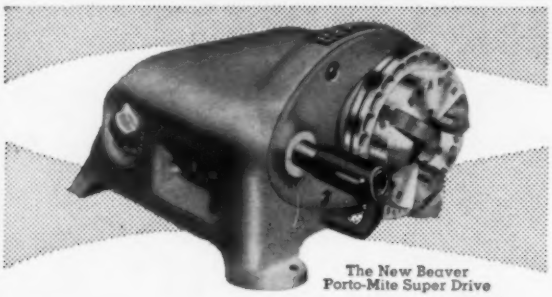

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be more specific on this point.—G.J.

A. The above quoted rule is similar to the provisions of Section 2125-b which reads, in part, as follows: "The total load (branch circuit) shall not exceed the branch circuit rating, and shall not exceed 80% of the rating where in normal operation the load will continue for long periods of time such as store lighting and similar loads."

The 1953 edition of the Abbott and Smith, N. E. Code Handbook, in discussing this rule advises that the term "long periods of time" is considered to be approximately six hours or more. As a result, we have an opinion which may be applied to Section 2116. I say opinion, since the code does not, to my knowledge, specifically cover the term "long periods of time."

According to the provisions of Section 3106 of the code, the maximum, *continuous*, current-carrying capacities of copper conductors are given in Tables 1, 2 and 3 of Chapter 10. This rule indicates to me that three No. 12 Type R conductors, installed in a conduit or cable, operating in a room temperature of 86°, will carry 20 amps indefinitely without exceeding its maximum operating temperatures of 140F. If this concept is correct, there appears to be no occasion for the 25% rule of Section 2116 other than to compensate the many variables involved with a field installation. In other words, a factor of adequacy is applied so that the many variables are reasonably satisfied. I believe we all know from field experience however that the rule is fully justified.

Reference to the publication, "Wires, Cables and Safety", presented by the National Electrical Manufacturers Association at the Silver Jubilee Meeting of the IAEI in 1953, indicates the many variables involved when determining the current-carrying capacity of a conductor. On page 14, the results of a test, under specified conditions, indicate that a 500 mcm conductor, loaded at 320 amps, reaches its maximum operating temperature between 8 to 12 hours depending upon air circulation. We believe this publication could be used to advantage in your code school.

In conclusion, we agree that the code should be more specific with regards to the term "long periods of time." This question has been a source of controversy for many years and should be clarified.—B.A.McD.

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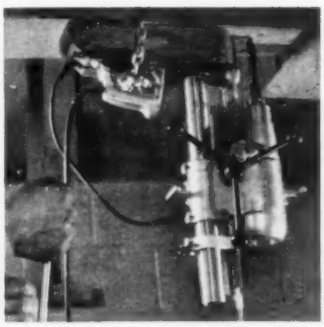

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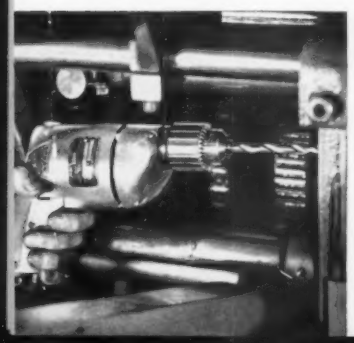

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. . . gives life-time wiring protection to Zanesville's Good Samaritan Hospital

Good Samaritan Hospital
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General Contractor: Knowlton Construction Company, Bellefontaine, Ohio
Electrical Contractors: Electrical Contractors, Inc., Columbus, Ohio

Failure of its all-important electrical system will never interrupt the smooth operation of the Good Samaritan Hospital in Zanesville, Ohio. That's because the builder of this well known institution wisely specified Youngstown's Full Weight Rigid Steel "Buckeye" Conduit for protection of the wiring system from damaging elements such as water, moisture, vapor, dust and dirt.

If the proper functioning of **your** electrical wiring systems—in any location, under any condition—presents a problem, then Youngstown "Buckeye" Conduit should be your specification. Reports from across-the-nation tell us, "It's easier to bend and thread, wire fishing is faster and easier—and its superior corrosion-resistance gives a much longer service life after installation"

Remember, Youngstown is the only producer of rigid steel conduit that controls all its integrated operations from ore mine to finish threading. Thus, you can be sure each length is of the same high quality that has made "Buckeye" Conduit the accepted standard of leading owners, architects and contractors everywhere.

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NISA Looks to Big Increase in Business by 1966

Vigorous growth and new responsibilities is the outlook for industrial electric service establishments forecast at record 25th NISA Convention in New Orleans. Paul M. Sievert named President.

"Materials, methods and management" summarized the main topics of discussion at this year's annual NISA convention which celebrated the Silver Anniversary of that association's founding as an industrial service organization. Held in New Orleans May 11-14, the meeting attracted a record-breaking attendance of over 1100 shop operators, manufacturers' representatives and guests from all sections of the U.S., its possessions and Canada. Following the popular format of former gatherings, the convention presented a slate of technical sessions, forums, shop visits and exhibits of products and equipment for the motor shop.

Also highlighting the convention was the election of Paul M. Sievert of the Sievert Electric Co., Chicago, as president of the association for the coming year; a reception honoring outgoing president Alfred Elson, Jr., president of the New England Machine & Electric Co., Pawtucket, R. I.; the recognition of 15 years of Association service by Fred B. Wipperman who officially retired from the NISA staff, and the awarding of certificates and cash prizes to eight winners of the annual "Shop Idea" contest.

Predictions of Growth

In keynoting the meeting, W. M. Wallace, general manager of the general products division and a vice president of Allis-Chalmers, urged NISA members to plan for an expected 230% increase in their business by 1966, stating that fractional-motor repair amounted to $120-million in 1956 and is predicted to exceed $400-million within a decade. Wallace also predicted that, by 1966, electric utilities would be generating a trillion kwh; electric products made in this country would be valued at $44-billion, and that fractional motors then in use would approximate 900-million units. Stating that this growth is a challenge and ultimatum for service as well as an opportunity for profits, he concluded that the "economic well-being of millions of people, as well as industry in general, may depend upon the effective planning, organization and job-execution of the motor-repair industry".

Speaking on Varnish Trends, William T. McClelland from the Sterling Varnish Co. in Sewickley, Pa., presented an interesting historic resume concerning such factors as development, application methods, curing, uses, synthetics, alkyds, silicones, polyester resins and solventless epoxy systems. In so doing, he showed how varnish provides mechanical strength to hold windings in place, physical protection against moisture and contaminants, a medium for heat dissipation and a barrier for dielectric action.

Another interesting discussion of Materials informed delegates as to What's Ahead for Insulation. In developing this topic, Graham L. Moses, manager for services engineering in the large rotating apparatus department of the Westinghouse Corp., stated that insulation is as important to the reliability of a motor as magnetic circuits, conductors and mechanical supporting structures. Insulation, he continued, is more than just a material. It has form and character; must support and separate conductors; must provide mechanical stability and may exist in the form of gases, liquids, solids or combinations thereof.

Looking to the future, he predicted that a major break-through in insulation development and research had occurred with the creation of the co-polymer solventless resinous system of bonding and impregnation. He also predicted that future insulations will occupy less space, will possess higher thermal endurance and will provide higher electrical strength. With this should come improved mechanical properties, toughness and "windability", permitting the development of smaller, more compact and more economical machines with greater reliability.

NEWLY-ELECTED PRESIDENT of the National Industrial Service Association is Paul M. Sievert of Chicago.

At the second general meeting of the convention, four interesting presentations were made. In the first of these, William S. Giles, Giles Armature and Electric Works, Marion, Ill., discussed "The Best Ways to Strip and Clean a Motor". He covered a suggested procedure for preparing a motor for rewinding. After extensive checking of a motor to be repaired—including ground and continuity checks, check of bearings, visual check of dismantled parts—the motor is ready for stripping. "Assuming that winding data is available, the stator is taken to coil clipper and one end of coils is clipped. If stator is too large for coil clipper, an air hammer and chisel is used. Should the winding data not be available, only part of the ends should be clipped, leaving sufficient coils intact to take necessary data. In order to preserve the appearance of the nameplates, they should be re-

UNBREAKABLE VINYL
— can't crack, chip, or break.

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DEAD FRONT CAPS
—back-wired for greater safety. No fiber washers to fuss with or lose.

NEW Unbreakable PVC ROYALOK®

ONE-PIECE CONNECTORS
— no eyelets or rivets. Double-wipe contacts permanently anchored in vinyl bodies.

RIGHT FOR EVERY JOB
— unbreakable vinyl resists acid, oil, grease . . . can't break under roughest use.

ONLY PVC ROYALOK® OFFERS SO MUCH!

SAFER, EASIER TO WIRE
— you get clean, safe wiring every time. Handy fact-tag with each device shows simple, easy wiring.

PVC ROYALOK is a full line of 2-, 3-, and 4-wire interlocking caps and connectors, 10 and 20 amp., which, because of their unique, unbreakable vinyl molded-in construction, set new standards for durability, safety and speed of wiring. See for yourself . . . order from your wholesaler or write on company letterhead for a free sample and catalog. Please give wholesaler's name.

ROYAL ELECTRIC CORPORATION
an associate of International Telephone and Telegraph Corporation
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An Associate of ITT

moved before burning off windings."

Walter Brush of Electric Motor Service, Birmingham, Ala. delivered an illustrated presentation on "How the NISA Standard Accounting System Has Helped Me To Learn My True Profit Picture." Using movies and still slides, he developed the complete method of accounting as it relates to operations in his shop. A minimum of careful paper work is associated with work flow through any part of the shop. Material and labor costs are accurately assigned to all phases of work, assuring effective cost control of all types of work.

In another illustrated presentation—color slides—E. C. W. Johnson and Albert Whisenand of Scherer Electric Co., Indianapolis, Ind., discussed the advantages of various types of equipment layouts as used in their own shop. A series of before-and-after slides demonstrated the value of efficient use of floor space by careful layout of machines and equipment. Layout must be carefully related to work flow through each section of the shop, assuring minimum time of work in transit from one work step to the next. And this layout must take into account the shape of the floor plan to provide plenty of free floor space in areas of heavy traffic. Blocking and congestion can quickly run up labor costs on shop work, in addition to presenting hazards to personnel and equipment.

Effective lighting as a major factor in quality motor repair work was also brought out during this presentation. Inasmuch as this shop was a single-floor building, much use was made of sky-lights strategically placed to provide high daylight intensities where detailed work was performed and on many machine tools where excellent visibility represents an important safety factor for operators. And artificial lighting in many shop areas is greatly supplemented by spill light from the several sky-lights.

John Arthur of Arthur Industrial Advertising Agency, New Orleans, La., discussed the role of advertising in modern business operations. He used a number of visual aids to emphasize his argument and played recorded commercials to drive home particular points.

Emphasis on Management

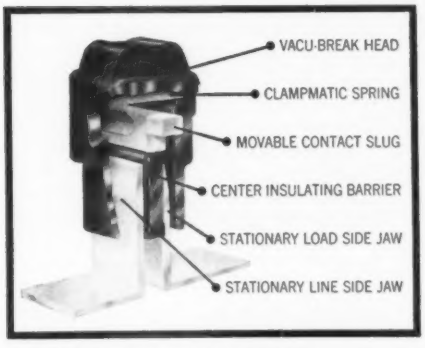
The third part of the conference theme, Management, was emphasized by James A. Phares, South-

Safest switches known

—in every size from 30 to 1200 amps

Large or small, BullDog Clampmatic® Vacu-Break® Safety Switches provide *maximum* protection . . . meet most every switching need. They provide added safety because of these two exclusives: The unique Clampmatic spring increases the pressure against contact jaws . . . assures clamp-tight connections . . . faster break . . . *really safe operation*. Vacu-Break action snuffs arcs immediately . . . reduces pitting and burning of contacts for long, trouble-free switch life.

BullDog's "Big Three" safety switches, the "Master", "Junior" and "Raintight", assure positive switching for every application. For this added safety, see your electrical distributor or BullDog field engineer for complete details, or write BullDog direct. © BEPCO



CLAMPMATIC VACU-BREAK — BullDog's unique Clampmatic spring clamps the contact slug between the line and load jaws. Constant pressure permits cool operating contacts. As the switch moves to "off", the spring accelerates the break. Vacu-Break action snuffs arcs immediately...minimizes damage to contacts.

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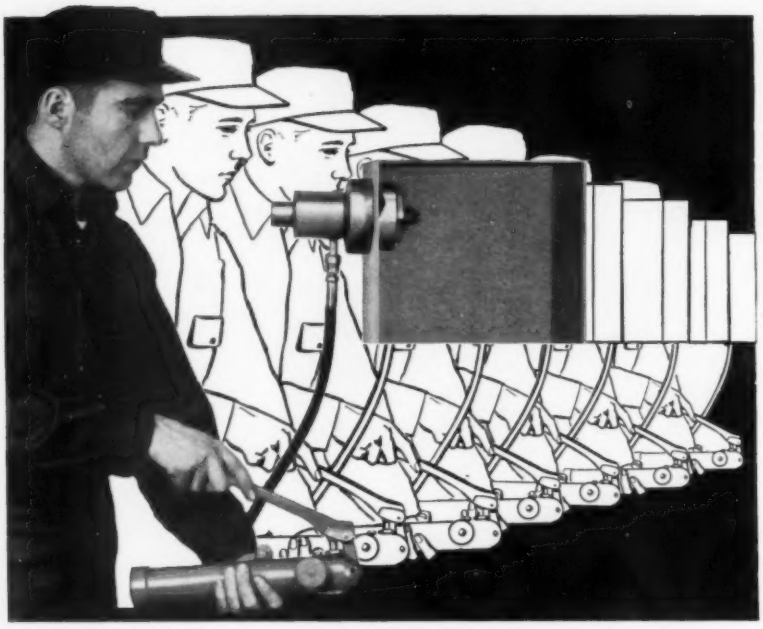
HEAT BETTER ELECTRICALLY

By Saving Minutes, You Save Hours

...WITH THE GREENLEE HYDRAULIC KNOCKOUT PUNCH DRIVER



You make smooth holes for up to 5-in. conduit *in seconds* with the GREENLEE No. 7646A Hydraulic Knockout Punch Driver . . . and the valuable minutes you save on every hole quickly add up to hours! This small and handy, yet extremely powerful, driver operates *all* GREENLEE Knockout Punches and is recommended for cutting entirely new openings in metal through 10 gauge. A few easy strokes of the handle, and the slug drops loose in the die! Ask your distributor for this timesaving drive—to use with your present GREENLEE punches—or the handy sets, including punches, shown below:

Set No. 7306, with punches for ½"—2" conduit

Set No. 7310, with punches for ½"—4" conduit

No. 7646A Hydraulic Knockout Punch Driver

Set No. 7304 —4 punches for 2½"—4" conduit
Knockout Punch No. 743 is available for 5" conduit

GREENLEE

WRITE for illustrated bulletin giving full details and prices.

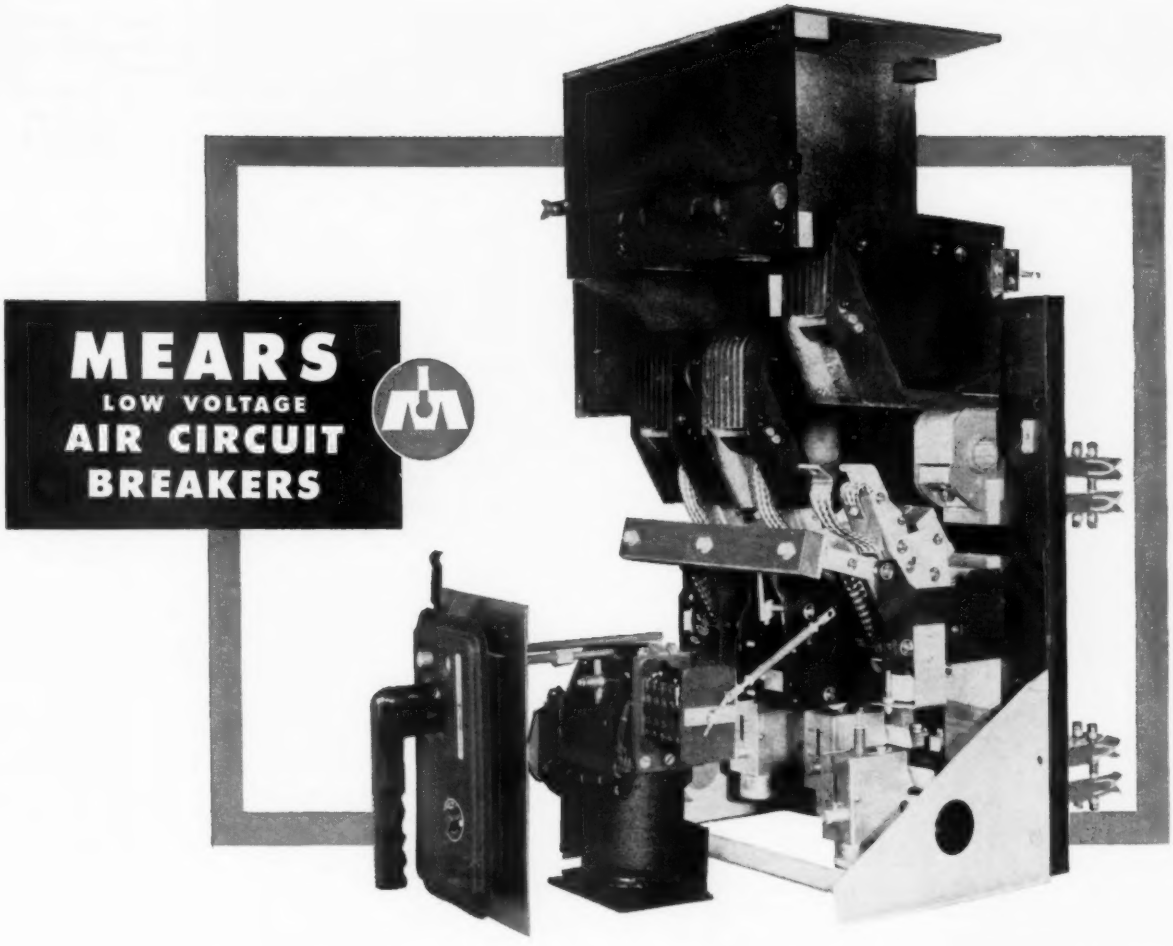
GREENLEE TOOL CO., 1746 COLUMBIA AVENUE, ROCKFORD, ILLINOIS, U.S.A.

H. C. BLENKHORN, newly-elected vice president of NISA, is president and general manager of Blenkhorn & Sawle, Ltd., St. Catharines, Ont.

west Electric Co., Oklahoma City, Okla., who discussed The Investment in Good Equipment; by William M. Hankins, Jr., president, The Fred W. Kiemle Co. and Bunting Brass & Bronze Co., Toledo, Ohio, who told delegates What I Saw as a Newcomer to Motor Management; by Carl L. Christiansen, sales manager, Dow Corning Corp., New York, N. Y., who analysed The Importance of Profits to Motor Shop Prestige, and by Earle L. Rauber, vice president and director of research, Federal Reserve Bank of Atlanta, who spoke on Economic Conditions that Affect the Motor Shop Industry.

In this presentation, Mr. Phares stated that shop owners have obligations to their employees to provide good equipment in a safe, pleasant place to work, and that better equipment in turn results in better work, more work per hour, more customer confidence and satisfaction, more new customers and a more complete service organization in general.

As a newcomer to the motor-repair industry, Mr. Hankins stated that an efficient shop should (1) properly identify its operations, (2) thoroughly analyze the market, its key personnel and the shop's ability to serve accounts, (3) develop a long-range plan for improvement and expansion, (4) properly use key personnel, (5) continue to train sales personnel, (6) keep abreast of financial matters in all its forms, (7) enlarge its top-management team, (8) improve both internal and external commu-



A circuit breaker must be 100% dependable

(or it is 100% worthless)

The dependability of a circuit breaker is something unique. It is built to handle a crisis that may never occur. Unable to flex its muscles regularly, its function is to rest in a state of inactive readiness for years on end. If it fails once it is a *total* failure.

There are two ways to check a circuit breaker's dependability. One is to assess its mechanical design in the light of an engineer's basic knowledge of electromotive and mechanical forces. Another is to look at the record. On both counts Mears invites the most searching inquiry. Many exclusive design features provide an exceptional margin of safety. As for the record—no Mears circuit breaker has ever failed, even after years of suffusion in the abrasive dust of cement mills or the corrosive fumes of chemical plants.

It will pay you to learn more about Mears low voltage air circuit breakers.

Mears circuit breaker features

- . . . Both electrical and manual operation.
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- . . . Operating torque with 300% safety margin.
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- . . . Extra wide range of ratings (can be sized to job).
- . . . Only West Coast breaker manufacturer.
- . . . Fast Delivery.
- . . . Up to 75,000 Amp interrupting capacity.

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Swan Island, Portland 17, Oregon

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Because Whitney Blake specializes in the manufacture of high quality wire and cables you will obtain long, efficient service from Whitney Blake Station Control Cables.
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Whitney Blake Station Control Cables can be supplied to your specification or designed for your application. Write for information on special constructions or for complete data on standard types.
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WELL BUILT WIRES SINCE 1899
WHITNEY BLAKE COMPANY
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nications, and (10) look for opportunities to put the Golden Rule into daily business relationships.

Relating Profits and Prestige, Mr. Christiansen mentioned that a service shop should be operated as a business rather than as a mere shop; that today people do not buy but are sold, and that a shop's only real product is service. With many clear illustrations he stressed the points that the good manager should sell better service rather than cutting prices; he should get out and see customers rather than rely upon mail-order and telephone contacts; he should be on the offensive rather than defensive, and he should strive to operate the best shop in the area rather than be content with providing merely adequate service.

In reviewing the current economic situation, Earle Rauber mentioned that although many markets and manufacturing volumes and profits were lower this year than last, electric power output was still on a slight increase, as were general wholesale prices. The figures, he stated, showed that although the present recession was of considerable dimensions, it was by no means catastrophic in magnitude. Our economy, he continued, is a buying and selling economy, and the wheels of industry turn in proportion to the rate at which business spends for new plans and equipment; people spend for consumer goods; business spends for inventories, and government spends for a range of programs as vast as the combined imagination of Congressional leaders.

Discussion Groups

Discussion groups covered insulation, small motors, large motors, transformers, methods and management. At the several discussion groups on motors, a wide range of technical details were covered on servicing, repair and rewinding of all types of ac and dc motors. The insulation group discussed the many new types of insulations available today, analyzing application and installation problems in everyday practice.

At the discussion session on transformers, many problems were discussed and methods were described. Highlights of this session were as follows:

1. There is a definite trend in application toward the use of transformers with as low internal impedance as possible. This came about as a result of the trend toward overload operation of trans-

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Complete line of 3-Wire Grounding Devices for Residential and Industrial Applications.

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For your wire requirements: Eastern Insulated Wire Corp. A Subsidiary
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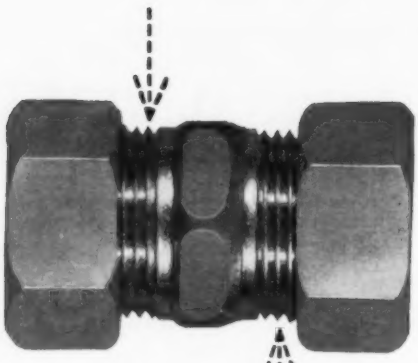

Full

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work faster and easier

BLACKHAWK EMT FITTINGS have full, true, perfect threads for ease and speed of installation. Bodies of heavy steel — cadmium and zinc finished to eliminate corrosion on the unit itself. Blackhawk's new EMT fittings are rain tight. Quality controlled at every phase of the manufacturing. In demand for electrical jobs large and small because they're easy to use.

Blackhawk's new EMT fittings are a product of continuing Blackhawk research and automated methods of manufacture. Order a stock today to meet the demand for these quality made, EMT fittings. A complete range of sizes is now available.

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Where the new ideas come from

Sherman Lugs

Sherman Solderless SS Type "All-Around" lugs are made in six sizes — #14 to 1000 MCM. Large contact surface for maximum conductivity. Open end barrel assures proper cable installation. Low silhouette — easy to install in tight places. Precision made and corrosion resistant.

Sherman — Known for quality since 1895.

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formers. Lower impedance transformers can provide the same amount of overload capacity as transformers of higher impedance without the severe drop in line voltage which results when the latter type are operated overloaded. This drop is very objectionable where the transformer supplies appliances and devices (TV, for instance) which are sensitive to low voltage. Of course, these lower impedance transformers can represent a handicap when providing protection against short-circuit fault currents. Such a transformer has a low limiting effect on short circuit current delivered into a fault on its secondary side. Rating of interrupting capacities, accordingly, have to be higher. But an even more serious problem is the effect of fault current on the transformer itself. Many such units can handle up to 25 times normal current but not 50 times normal.

2. Due to use of modern steel laminations, transformers have much more capacity per pound of core material than they did years ago. The capacity per pound has been increasing steadily through the years up to today's cold-rolled oriented steel.

A lively, overtime discussion marked the management session. The whole gamut of business and operating problems was covered in this study group. Subjects included: shop organization, personnel selection, inventory control systems, job cost system, overhead and cost control, collections and credit, employer-employee relations.

Pro and con arguments were made for application of different overhead rates to each operating department. Detailed discussion of

PRACTICAL SHOP ideas are the forte of Fred N. Selby, Lansing Electric Motors' partner in charge of motor and equipment repairs at Lansing, Mich. Many production equipment items in the shop are the products of his fertile imagination.

allocation of service charges to various operating departments showed the need for cost control to be related to the size of the shop. Size of shop was also the important factor in determining "fringe benefits" to employees.

On the subject of labor relations, several interesting points were discussed. The importance of keeping employees informed on company organization was firmly stressed. A good employee communication system is essential, particularly in large shops. It was also felt that an established procedure on setting salaries and wages is an element of effective shop management. And training programs, safety programs and incentive plans are well worth the time and effort expended on them by shop management.

Shop Ideas Recognized

In the annual Ideas Contest, Stanley Newhard of Kirby Risk Electric Motors, Inc., Lafayette, Indiana, won a $100 first prize in the Management Division for his description of how his company has coordinated the numbering of its job tags with numbers on the storage shelves in its shop, so that the last digit of the tag provides a ready reference to the location of the motor in question. A similar prize in the Shop Division went to Robert F. Janes, MQN Electric Motor Service, Mentor, Ohio, for a redesigned oil burner transformer which, when connected to a 100-w lamp, a single-pole single-throw switch, and equipped with two high-voltage test leads and alligator clips, enables the operator to detect short and open circuits as well as other faults.

Second-place prizes in the amounts of $75 went to Alex C. Shovan, Jr., Industrial Electric Service Co., Hawthorne, N. J., for the technical library his firm has acquired for employee reference; and to Wilson G. Dunn, Jr., Electric Motor and Repair Co., Richmond, Va., for a rig to belt down motors and generators.

A single-operation one-form system for invoicing electrical repairs won a $50 third prize in the Management Division for Electric Motor Service, Inc., Birmingham, Ala.; while a similar award in the Shop Division went to Fred Binkley, Tennessee Electric Motor Service, Nashville, Tenn., for his development of an aid in insulating motors with epoxy insulations.

Fourth-place prizes in amounts of $25 were won by Allen Roberts, Stultz Electric Works, Westbrook,

NOW! TAKE THE BLISTERS OUT OF FISH-TAPE WINDING WITH . . .

Hi TAPE-MATE

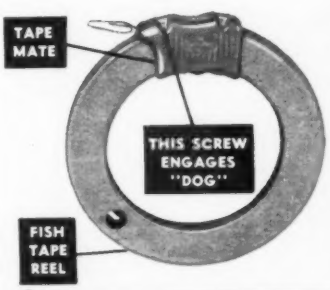
THE PERFECT "MATE" FOR FISH TAPE REELS!

TAPE-MATE is a new re-winding attachment that fastens securely to reel . . . Wrap-around design keeps hands in complete control — there's no need to ever touch tape during winding. TAPE-MATE winds tape fast with an easy, sliding action (you can put 100' of tape back on reel in less than 5 minutes) . . . Tape coming off reel is safe—Keeper slot prevents "springing." Steel "dog" or guide presses tape into reel in uniform layers!

EVERY ELECTRICIAN SHOULD HAVE ONE — "Hi" TAPE-MATE modernizes all your present reels . . . protects your hands and eliminates kinks and broken tape.

TAPE-MATE comes in 2 sizes . . . fits all Holub and other 8½" and 12" dia. round fish tape reels containing ⅛" flat fish tape. AND IT COSTS SO LITTLE . . . ONLY $2.75!

Here's the complete unit . . .



TAPE-MATE comes in two sections. Place sections over reel, insert 4 screws and tighten. That's all you do! TAPE-MATE can't come off . . . no moving parts to repair or replace.

"Hi" FISH TAPE REELS have offset seam, no sharp edges, hold tape securely, contain the highest quality fish tape made! Five sizes fit TAPE-MATES.

NEW! Deluxe chrome plated "Hi" FISH TAPE REEL with TAPE-MATE attached —2 sizes!

OTHER "Hi" QUALITY PRODUCTS
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PLEASANT RETREAT from conventional office atmosphere is this conference room with home-like decor at Grand Rapids Industrial Electric Company's headquarters in Grand Rapids, Mich. Investment has been returned many times over in better customer relations, president H. D. Jeffries reports.

Maine, for his method of using a knife to remove square edges of wedges; and by Jack Ford, Standard Electric Motor Repair, Linden, N. J., for his daily-service-call logbook.

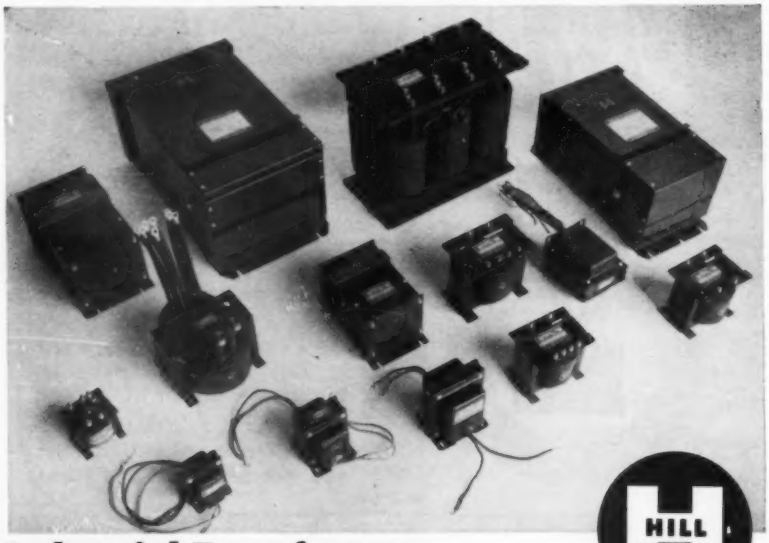
Seventy-nine entries were submitted for the contest by shops from every region of the U. S. and Canada. Prizes were judged on a system of points; originality counting 20 points, adaptability 20, preparation 10, simplicity of construction 5, and "exhibit ability" 3.

Entries were judged last month at the NISA headquarters in St. Louis by Alex A. Shovan, contest chairman, of Industrial Electric Service Co., Hawthorne, N. J.; H. Edward Grant, Tennessee Electric Motor Service, Nashville, Tenn.; Thomas M. Paul, Paul Electric Co., Sioux City, Iowa; and Jack G. Persson, Electric Apparatus & Repair, Philadelphia. A display of the entries was a popular convention attraction.

New Officers Elected

Coincident with the election of Paul Sievert as national president for the coming year, H. C. Blenkhorn, president of Blenkhorn & Sawle, Ltd., St. Catharines, Ontario, Canada, was elected vice-president; J. Arthur Turner, Jr., of Tampa Armature Works, Tampa, Florida, was chosen secretary, and Carl L. Lundberg, Cascade Machinery Works, Seattle, Washington, was selected as incoming treasurer.

At the annual business luncheon, Joe Harrington, completing his first full year as NISA's executive vice-president, gave a brief review of the Association's service and steady



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Power and distribution transformers—Oil Filled, Askarel, Dry Types—available through 5000 KVA. All manufactured to NEMA and ASA standards.

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growth, stating that NISA membership now is 1664; that a potential list of around 500 shops would be contacted shortly in a concentrated membership effort; and that next year's convention would be held in the Queen Elizabeth Hotel in Montreal, May 17-20.

Responsible for the success of the meeting were such New Orleans personalities as S. J. Stewart, general chairman; co-chairman Charles W. Hiers, New Orleans Armature Works; Edward K. Richardson, Industrial Electric, Inc., arrangements; Barney V. Oufnac, Advance Electric, Inc., exhibits; William A. Dreis, transportation; Aneblo Dallocchio, Standard Electric Motor Service, shop tours and, responsible for the women's program, co-chairmen Mrs. Leonce Bonnecaze, Mrs. Margaret S. Johnson and Mrs. Harry Mentrup. This local nucleus was aided materially by members of NISA's headquarter's staff; executive v-p Joseph M. Harrington, retiring consultant Fred B. Wipperman, staff engineer C. H. Lankford, office manager Marion H. Wassell and NISA News editor H. B. Barks.

Serving as chairmen for the three morning technical sessions were William J. Wheeler, New York City, who also served as NISA's national president in 1937-8; Charles C. French, St. Louis, NISA's president in 43-4, and Howard (Ed) Grant, Nashville, president in 1950-1. General sessions chairman for the 2nd and 3rd day were Edward K. Richardson and Charles W. Hiers of New Orleans.

NALMCO Holds Annual Conference

The National Association of Lighting Maintenance Contractors held their fifth annual conference recently in Cleveland, Ohio. It was a three-day affair, held at the Hotel Statler on April 28, 29, 30, and was devoted to business sessions and talks by various Association members and leaders from other related industries.

Business sessions were chairmanned by Glen Shatola, Lighting Service Co., Milwaukee, NALMCO President. These included such subjects as financial report, report of Membership Committee, voting on new members, report of Nominating Committee and nominations for officers for the fiscal 1958-59 year, report on Plant Maintenance Show (Chicago—1958) booth, report of National Accounts Committee, round table discussion of Forms

TORK

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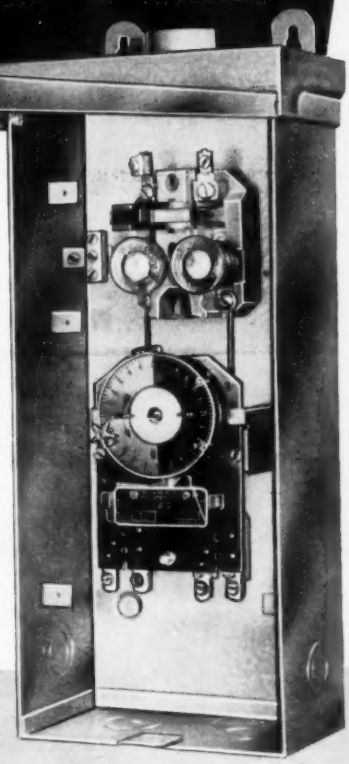

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Requires no set up time and presents no problems for drilling holes close to walls or in corners—one man can carry it up stairs.

Using diamond bits, it drills neat, clean holes vertically, horizontally or at any angle in concrete, asphalt, marble, granite, including any pipe, conduit, steel, etc. that might be encountered in the drilling.

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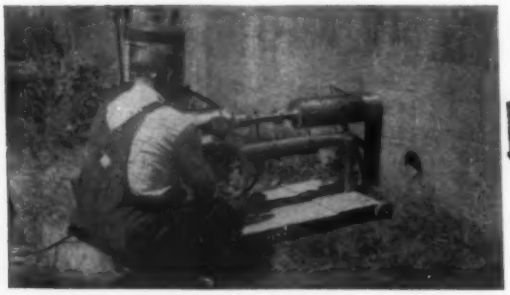

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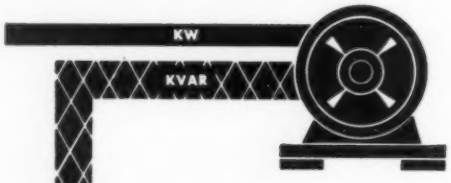

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PETROLEUM INDUSTRY electrical maintenance practices and problems was subject of this panel at recent meeting of Southern Section, Electrical Maintenance Engineers of Chicago. Panel experts were: (L to R) George Mills, ass't. general foreman, electrical department; J. W. Windhurst, staff engineer; J. C. Howard, ass't chief engineer; W. L. Moser, staff engineer—all of Standard Oil Company of Indiana; and E. E. Hoyle, electrical engineer, Sinclair Refining Company.

and Reports, reports of Sales and Advertising Committees, election of officers, formation of new committees, selection of committee chairmen for the coming fiscal year, and report on Standing Committee meetings by Committee chairmen and members.

Other features of the conference included talks by visiting guests, a banquet and dance with entertainment held in the Terrace Room of the Statler, and a visit to Nela Park and the General Electric Lighting Institute, participated in by all members and their wives and guests, as guests of the General Electric Company Lamp Department.

D. R. Thomas of the Westinghouse Lamp Division discussed new lamp developments by his Company, and the importance of adequate lighting maintenance to insure maximum light at a minimum of cost. He predicted a high growth rate for the new super high output (SHO) fluorescent lamps, and pointed out the need for proper ventilation of luminaires using these lamps to insure trouble-free operation of the ballasts, and maximum light output. He recommended group relamping, and described how this can be done for the benefit of the customer as well as of the maintenance contractor, and presented a 12-minute strip slide film in support of a group relamping program.

Representatives of the General Electric Company Lamp Depart-

ment, consisting of J. H. Mattoon, Ed Thermak, and Richard Lundgren, presented a program covering various problems in the field of contract lighting maintenance. These included group relamping procedures and costs, new lamp developments, and the many problems faced in organizing and operating a lighting maintenance service. A newly developed booklet telling how to organize and operate a lighting maintenance service, and outlining methods of promoting and selling such a service, was distributed, and the various ideas discussed in some detail.

Sylvania Electric Products Inc. was represented by L. Pleasants and R. E. Smart. New lamp developments were discussed briefly, and other lighting maintenance problems as faced by lighting maintenance companies were also covered. Some national statistics covering lamp purchase practices by small industrial firms were also shown by means of slide charts and tables, which evoked considerable discussion. Mr. Pleasants pointed out the need for increased activity in the field of lighting maintenance services in every community across the nation, to keep pace with the tremendous growth and progress in lighting application.

Forms, reports and office procedures currently in use in the lighting maintenance service business were reported on in a round table discussion led by NALMCO member Elmo Irwin, Lighting Services, Inc., St. Louis, Mo.

Another presentation by a NALMCO member which was of popular interest to all was a 12-minute 8-mm movie by Malger Gray, Fluorescent Service Corp.,

AT NISA Northeastern Conference in Hartford, Conn., from left: George Treiber of John C. Dolph Co., Monmouth Junction, N. J.; Charles S. Dell of Brownell Distributors, Cambridge, Mass. and John P. Lynch of Lynch Electric, Wrentham, Mass.

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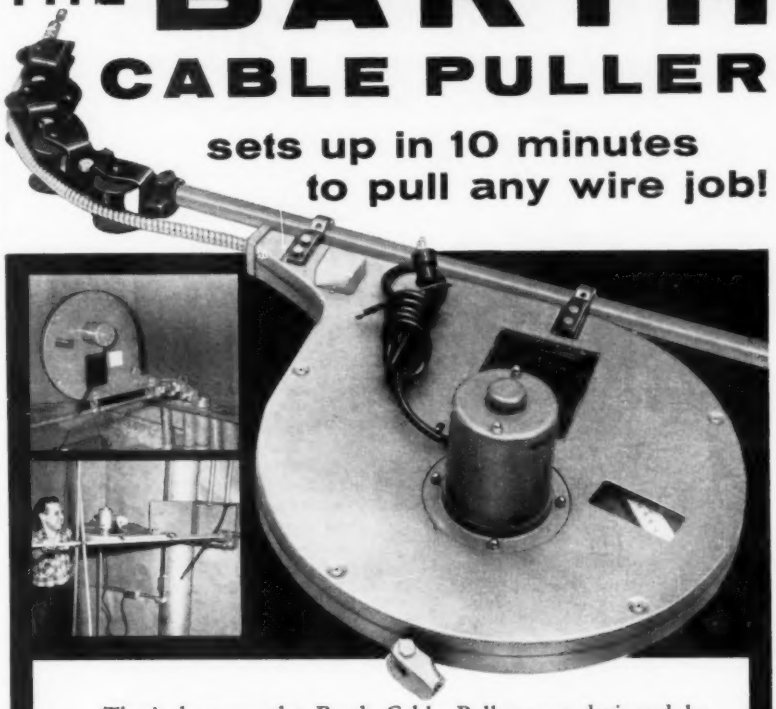

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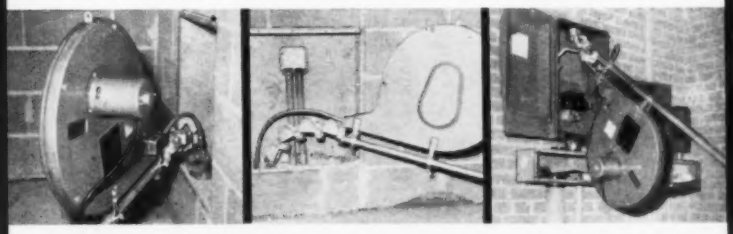

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AT NISA Northeastern Conference in Hartford, Conn., from left: Henry Allmaras of Tiret Electric Co., Long Island City, N. Y.; William Weirich, Lenni Products, Lenni Mills, Pa.; and Martin Giragosian and Harold Alerud of Wheeler Service, Cambridge, Mass.

Tampa, Fla., in which he showed a new type of washing machine developed by him to speed up and cut costs of washing and cleaning all types of louvers, lenses, industrial reflectors and diffusers, including corrugated vinyl and molded plastic materials. The movie showed the machine in use, cleaning these various materials, and its showing was accompanied by a running commentary by Mr. Gray.

The conference concluded with an afternoon program sponsored by the Lamp Department of the General Electric Company, which included a visit to the General Electric Lighting Institute, and short talks and demonstrations covering a wide range of topics: Lighting the Home; School and Office Lighting; Lighting for Merchandising; Lighting for Production; and the showing of two films—"How to Make a Lamp Bulb", and an industrial slide film.

New NALMCO officers selected for the next fiscal year (beginning May 1, 1958) were: President—Glen Shatola, Lighting Service Co., Milwaukee, Wis.; Secretary—Robert E. Watson,. The Fluorescent Maintenance Co., Denver, Colo.; Treasurer — Herbert Mendelsohn, Sun Ray Lighting Corp., Kansas City, Mo.; Regional Vice Presidents—Western Region, Gerald Joseph, Lighting Maintenance Co., Albuquerque, N. M.; Midwestern Region, Elmo Irwin, Lighting Services Inc., St. Louis, Mo.; Central Region, Edward I. Creed, C & S Lighting Maintenance Co., Cleveland; Eastern Region, Barney Roth, Barney Roth Co., Philadelphia, Pa.; and Southern Region, Walter C. Fink, Jr., Senior Fluorescent, Inc., Atlanta, Ga. The next annual conference will be held in Denver, Colo.

FRANK STETKA, recently appointed Field Engineer for the National Fire Protective Association, is firmly adjusted to his Chicago office. He is pictured here "catching-up" with some of the heavy correspondence his new position requires. Secretary is Mrs. Cecilia Wolfe.

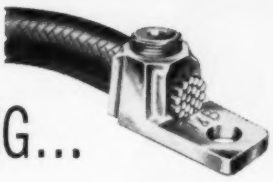
Chicago Adopts Certified Lighting Program

The Chicago Lighting Institute has initiated a Certified Lighting program for the Chicago area and surrounding counties, and has made formal application to the National Lighting Bureau for authorization to operate the certification program in that area. The primary objective is to stimulate the sale and installation of better commercial and industrial lighting installations in the area.

The new program will embrace three lines of endeavor: 1) train electrical contractors and other lighting salesmen in technical as well as sales aspects of lighting; 2) educate management of offices, stores, schools and small plants in the desirability of installing proper lighting to benefit their respective activities, through promotion and advertising; and 3) carry on a certification program for lighting plans which meet requirements outlined by the National Lighting Bureau and the Chicago Lighting Institute.

It is expected that this dual effort to stimulate electrical contractors and other lighting salesmen to initiate and develop sales in the relighting market, and to create a climate for such sales among potential customers, will develop the vast market of commercial and industrial establishments which are now inadequately lighted. It is estimated that this market represents about 85% of existing stores, offices, schools and factories, or a far greater dollar potential than even the new construction field.

INTRODUCING...



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Electric League for Atlanta

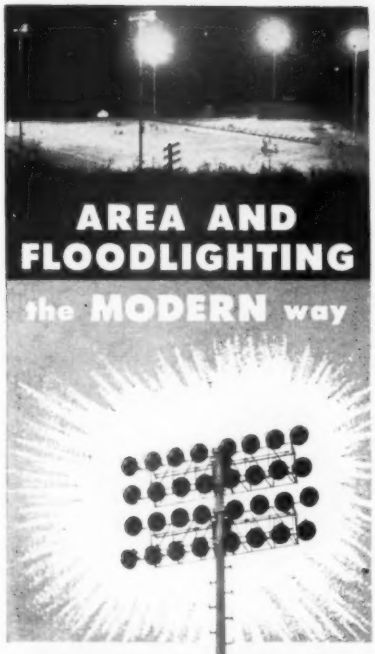
The electrical industry in Atlanta, Ga. and surrounding trading area is in the process of organizing an Atlanta Electric League, and with a practical method of underwriting its operating costs.

Basic aim of the league will be the same as that of other successful Electrical Leagues in the larger metropolitan areas of the country. Electrical leaders in Atlanta feel there is a great need for such an organization, and that continued delay in establishing such a League will affect the industry adversely.

The new League has devised a novel method for paying for official quarters and space, including costs for a staff and amortized improvement costs. It has an option on the entire second floor of the Atlanta Architects and Engineers Institute building, owned and controlled by the architects and engineers of Georgia. Approximately 12,000 sq ft, or three-fourths of the area, has been made available for rental to manufacturers of electrical equipment for display purposes. The floor space is available for displays of standard electrical equipment, and the ceiling space over the same area is available for lighting displays by manufacturers.

Associate and sustaining memberships are available to those without products to display. Associate membership is available to engineers, architects, electrical contractors, electrical inspectors, etc., while sustaining membership is offered to electrical wholesalers, electrical utilities, and lamp manufacturers. Advance reaction and space already committed indicates an overwhelming acceptance and assured success of the League, according to its Steering Committee.

WINNER of the non-residential division in the IES Northeast MMILJ Contest was N. S. Florence (left) who received congratulations, a certificate and check from National President Kirk Reid at the Regional Conference in Hartford, Conn.



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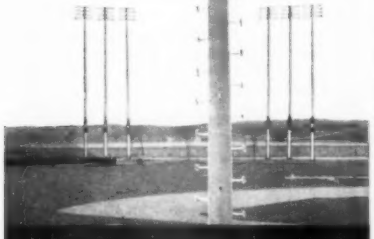

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DATES AHEAD

National Society of Professional Engineers—Annual meeting, Chase-Park Plaza Hotels, St. Louis, Mo., June 11-14.

Construction Industries—13th annual Exposition and Home Show, Pan Pacific Auditorium, Los Angeles, Calif., June 12-22.

American Society of Mechanical Engineers—Semi-annual meeting, Statler Hotel, Detroit, Mich., June 15-19.

Fifth National Store Modernization Show—Coliseum, New York, N. Y., June 23-26.

American Institute of Electrical Engineers—Summer general meeting, Buffalo, N. Y., June 23-27; **Pacific general meeting,** Hotel Senator, Sacramento, Calif., August 19-22; **Fall General meeting,** Penn-Sheraton Hotel, Pittsburgh, Pa., October 27-31.

Illuminating Engineering Society—Great Lakes Conference, Sheraton Hotel, Rochester, N. Y., June 23-24.

National Association of Electrical Distributors—50th annual convention, Civic Auditorium, San Francisco, Calif., June 9-13.

Edison Electric Institute — Annual convention, Convention Hall, Boston, Mass., June 9-12.

New York State Assn. of Electrical Contractors & Dealers, Inc.—Annual convention, Whiteface Inn, Lake Placid, N. Y., June 29-July 4.

American Institute of Architects—National convention, Carter Hotel, Cleveland, Ohio, July 7-11.

Illuminating Engineering Society — National Technical Conference, Toronto, Canada, August 17-22.

International Association of Electrical Inspectors—Western Section, Sheraton-Cadillac Hotel, Detroit, Mich., September 7-10; **Northwestern Section,** Billings, Mont., Sept. 15-17; **Southwestern Section,** Southern California, September 22-24; **Canadian Section,** Montreal, Quebec, Canada, October 3-4; **Eastern Section,** October 13-15; **Southern Section,** Miami, Fla., October 20-22.

Western Electronic Show & Convention—Pan Pacific Auditorium, Los Angeles, Calif., August 19-22.

International Association of Electrical Leagues—Annual Conference, Washington, D. C., October 1-3.

Canadian Electrical Manufacturers Association — Annual convention, Sheraton-Brock Hotel, Niagara Falls, Canada, October 8-10.

National Electronics Conference, Inc. —Hotel Sherman, Chicago, Ill., October 13-15.

National Electrical Manufacturers Assn.—Annual conference, Hotel Traymore, Atlantic City, N. J., November 10-14.

National Electric Contractors Assn., —Annual convention and National Electrical Exposition, Adolphus Hotel, Dallas, Texas, November 16-21.

American Society of Mechanical Engineers—Annual meeting, Hotel Statler and Sheraton McAlpin Hotel, New York, N. Y., November 30-December 5.

2nd National Lighting Exposition—Coliseum, New York, N. Y., March 1-4, 1959.

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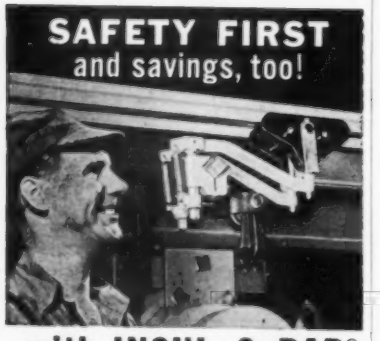

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Headquarters Announcements

Hill Transformer Co. Inc., San Carlos, Calif.—Charles S. Allen Jr., head of new electric utility sales division.

Ridge Tool Co., Elyria, Ohio—James E. Butler, manager, sales promotion.

Conduflor Corp., Cleveland, Ohio—Stuart C. Cline, sales manager.

Edwin L. Wiegand, Pittsburgh, Pa.—T. A. McLean, advertising and sales promotion manager.

Porcelain Products, Inc., Carey, Ohio—Allan G. Smith, Jr., zone sales manager, Carey Division.

I-T-E Circuit Breaker Co., Philadelphia, Pa.—H. David Honan, manager, industrial sales; Arthur Curtin, manager, contractor sales.

BullDog Electric Products Co., Detroit, Mich.—A. L. Nolan, manager, special projects.

Triangle Conduit & Cable Co., Inc., New Brunswick, N. J.—John E. McAuliffe, chairman of the board; Joseph G. Slater, president; Carl S. Menger, executive vice-president; Jack M. Slater, treasurer; Carl S. Menger and Clyde V. McKay, new members of the board.

Wagner Electric Corp., St. Louis, Mo.—J. H. Devor, president; H. N. Felton, vice president in charge of sales; Paul C. Ford, vice president in charge of engineering and research; R. H. Hackett, vice president in charge of manufacturing.

Day-Brite Lighting Inc., St. Louis, Mo.—Stanley M. Bixler, senior vice president and general manager.

Universal Motor Co., Oshkosh, Wis.—Dwight Pickering, assistant to the president.

C & D Batteries, Inc., Conshohocken, Pa.—Frank S. Carlile, chairman of the board; John F. Rittenhouse, president. Board of directors: Frank S. Carlile, John F. Rittenhouse, Felix W. Altrup, Thomas L. Caldwell, Henry E. Jensen, Stewart E. Doughty, Louis M. Eble, Jr., Robert M. Pease, John F. Simon, Jr., Edwin Booth, H. Russell Stewart, Jr., Frank S. Glendening.

Pioneer Gen-E-Motor Corp., Chicago, Ill.—Roy L. Jenkins, sales manager, Electric Generator and Power Plant Division.

Sola Electric Co., Chicago, Ill.—Alvin S. Levine, manager, lighting sales.

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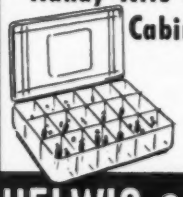

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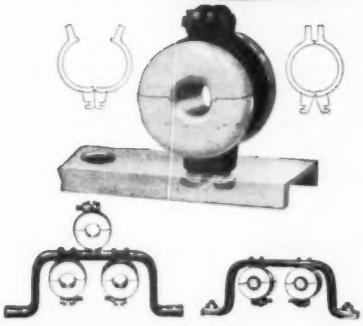

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SOUTH ATLANTIC

Moe Light Div., Thomas Industries: James E. Lathrop, Jr., Virginia Beach, Va., representative in Virginia.

Sunbeam Lighting Co.: Perry G. Sessoms, Jr., representative in Georgia-Alabama area.

Electro Silv-A-King Corp.: W. H. Newman, Decatur, Ga., district manager for state of Georgia.

EAST CENTRAL

Federal Lighting Corp.: David Dietz, Jr., representative in Greater Cleveland area.

John C. Virden Co.: Donald Becker, sales representative in Central Indiana and Central Illinois areas.

Frink Corp.: Virgil E. Marshall, representative in Indiana.

Pittsburgh Reflector Co.: James F. Ligon, representative in Ohio, West Virginia and Kentucky.

Century Electric Co.: Frank Hatfield, manager of new office-warehouse in Cleveland, Ohio.

WEST CENTRAL

Century Electric Co.: Baker Terry, manager, St. Louis branch office; R. A. Jervis, manager of Tulsa, Okla., branch office.

Moe Light Div., Thomas Industries: H. H. Schwark, Jr., representative in Dallas, Tex.; Lee T. Kimmel, Prairie Village, Kans., sales representative.

Whitney Blake Co.: Wallace H. Johnson, representative in New Mexico, Louisiana, Southern Mississippi, and Texas, office in Dallas.

Minneapolis-Honeywell Regulator Co.: Harvey W. Odom, sales manager, industrial branch office in New Orleans.

WEST

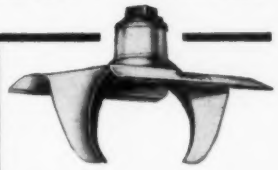
Sunbeam Lighting Co.: L. S. Reed & Co., Denver, representative in Colorado-Wyoming area.

Daniel Woodhead Co.: Kenneth Anderson Co., Los Angeles, representative in southern California-Arizona territory.

Century Electric Co.: Ted A. Bender, manager, Seattle office.

Allis-Chalmers Mfg. Co.: Richard L. Engel, manager, Pacific Region; Donald E. Steele, manager, Los Angeles district.

WITH
MULTI "ILE-LITES"



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EMPLOYMENT EQUIPMENT — USED OR BUSINESS RESALE
OPPORTUNITIES

Wire and Cable When You Want It!
From Chicago you can get immediate delivery on all types of Electrical Cable. Order today; we ship the same day. Let us supply your wire requirements.
UNIVERSAL WIRE & CABLE COMPANY
2919 N. Paulina Street Chicago 13, Ill.

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CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

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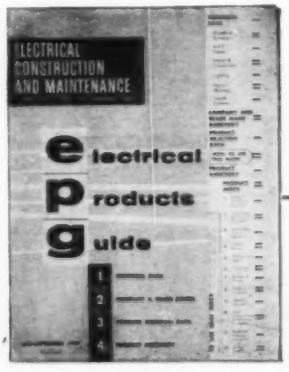
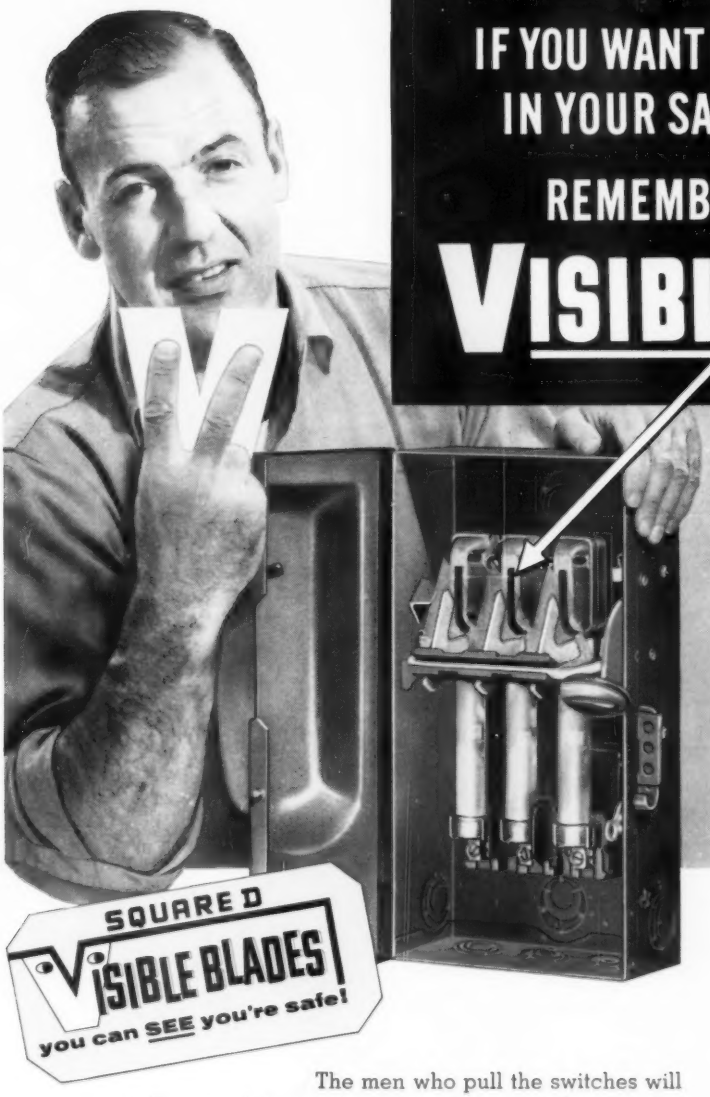


• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE

For more complete information, and application data on their lines, refer to the index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

IF YOU WANT COMPLETE SAFETY IN YOUR SAFETY SWITCHES— REMEMBER THE "V" FOR VISIBLE BLADES!



The men who pull the switches will tell you what can happen when a switch, *believed* to be open—*isn't.* A lot of things can happen—and every one of them is bad. Personnel safety is in jeopardy. Motors can single-phase. Machinery and work can be damaged. Down-time can skyrocket.

Doesn't it make sense to insist on Visible Blade construction which gives you a road block against any of those possibilities? Doesn't it make equally good sense to insist on the safety switch which gives you that construction—plus a lot of other performance advantages?

HERE IS ANOTHER REASON WHY SQUARE D HAS HELD FIRST PLACE FOR MORE THAN 50 YEARS

Positive Pressure (SPRING LOADED) Fuse Clips

✓ Maintain positive contact as fuses alternately heat and cool. Fuses are held tight even where vibration is present or during short circuit surges.

✓ Fuse clip jaws use pure copper for current-carrying parts and spring steel for pressure. They reduce heating 80% over commercial type clip.

✓ No clamps or screws to tighten—or to forget to tighten.

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

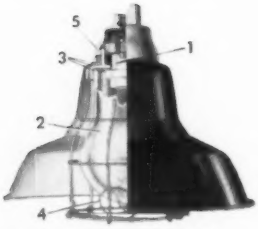
Cuts Re-lamping Costs

IN HALF!

Adapts For Larger Lamp Size

WITHOUT RE-WIRING!

New CROUSE-HINDS VAPORMASTER® Lighting Fixtures



1 *Shock-absorbing receptacle* — takes jolts from any direction. **2** *Pear-shaped globe* — plenty of clearence for lamp. **3** *Vapor-tight seals throughout* — fully gasketed construction. **4** *Globe clamping spring* — flips open for re-lamping — no tools needed. **5** *Aluminum adapter-guard* — 2 sizes fit *all* Condulet bodies.

Here is vapor-tight, shockproof industrial lighting engineered for the greatest possible economy and convenience in both installation and maintenance.

In any indoor or outdoor exposure to moisture, rain, gases, dirt, or corrosive vapors . . . a new standard of operational efficiency is set by the new VaporMaster series. Cleaning and re-lamping is done in half the time, *without tools*. Whenever a demand for a change in lighting intensity develops, a simple change of adapters accommodates the larger lamp — without touching the wiring!

Hundreds of fixture combinations may be assembled from 33 standard components to meet your varying needs. Typical choices:

- *Condulet® bodies* in pendent, ceiling or bracket types and with side hubs.
- Adapters in two forms . . . one for lamps up to 150-watts A23 . . . one for 200- and 300-watts PS30 medium base lamps. Sizes may be changed without disturbing wiring merely by installing adapter for the desired lamp.

ASK FOR CATALOG INFORMATION ON THE VAPORMASTER SERIES TODAY

Just call your Crouse-Hinds distributor . . . or nearest Crouse-Hinds office.

A NATIONWIDE **DISTRIBUTION** exclusively through **ELECTRICAL DISTRIBUTORS**

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